N00204.AR.005302
NAS PENSACOLA
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FINAL FOCUSED FEASIBILITY STUDY OPERABLE UNIT 10 (OU 10) NAS PENSACOLA FL

10/26/1995

ENSAFE ALLEN AND HOSHALL

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY
NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

CTO-048

FINAL FOCUSED FEASIBILITY STUDY
OPERABLE UNIT 10

Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA

SOUTHDIV CONTRACT NUMBER: N62467-89-D-0318

Submitted by:

EnSafe/Allen & Hoshall
5720 Summer Trees Drive, Suite 8
Memphis, Tennessee 38134
(901) 383-9115

October 26, 1995

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Release of this document requires prior notification of the Commanding Officer of the Naval Air Station, Pensacola, FL

FOREWARD

This Focused Feasibility Study presents remedial alternatives for soil for OU 10 at NAS Pensacola. The *Final Remedial Investigation Report* for OU 10 recommended that all groundwater actions be implemented under the current RCRA program.

In reviewing this document, it is important to note that the presentation of remedial alternatives addresses human health risks calculated using a residential scenario, and environmental risks (e.g., threats to groundwater) identified using the Florida Department of Environmental Protection (FDEP) *Soil Cleanup Goals for Military Sites*. As discussed in Alternative 2 (institutional controls) no further actions are required for protection of human health at OU 10 under an industrial-use scenario. If an industrial scenario is pursued, the only portions of this document pertinent to potential remedial actions are those that address soil leachability.

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EXECUTIVE SUMMARY

This Focused Feasibility Study (FFS) develops, evaluates, and compares four remedial action alternatives that may be used to mitigate hazards and threats to human health and the environment at Operable Unit 10 (OU 10) at Naval Air Station (NAS) Pensacola. The FFS addresses soil alternatives only; groundwater is addressed as per recommendations in the *Final Remedial Investigation Report, Naval Air Station Pensacola, Operable Unit 10 and Site 13* (EnSafe/Allen & Hoshall, September 1995) (RI).

The FFS evaluates the RI, the baseline risk assessment (BRA), and potential applicable, relevant, or appropriate requirements (ARARs) to develop preliminary remediation goals (PRGs) for OU 10. The BRA did not identify any risk to current or future workers onsite above the $1x10^{-6}$ threshold; no further action would be required for protection of human health under an industrial scenario. However, when a residential scenario is evaluated, two compounds were identified in site surface soil contributing risk greater than $1x10^{-6}$ to a future resident child: benzo(a)pyrene and dibenz(a,h)anthracene. The BRA did not identify any other compounds that posed risk above the $1x10^{-6}$ threshold or contributed to exposures above a hazard quotient of 1.0 under any future-use scenario. No risks to the environment (e.g., ecological risks) were identified in the BRA. However, the Florida Department of Environmental Protection (FDEP) memorandum *Soil Cleanup Goals for Military Sites*, regarded as "to be considered" (TBC) criteria for the site, were used to identify five compounds present in site soil above leachability-based guidance concentrations that are also present in groundwater above maximum contaminant levels (MCLs) or Florida groundwater guidance concentrations. These data are used to assemble PRGs for OU 10 that are protective of human health under a residential scenario and of the environment using leachability-based guidance concentrations.

PRGs are used to identify four areas considered during the FFS. One area, west of Site 32, was identified due to human health risks posed by a residential scenario. Three areas (two in the swale, one adjacent to a former waste oil pit) were identified using leachability-based guidance concentrations; chlorinated benzenes and naphthalene are the chemicals of concern in these areas.

Four alternatives are developed and screened in this FFS to meet residential and environmental PRGs:

- No action, including site monitoring once every five years and maintenance of site security.

- Institutional controls, including restricting future land use on Magazine Point to the industrial scenario, and a leachability study to assess site-specific threats to groundwater.

- Capping, including design and construction of asphalt caps over all four areas similar to the existing RCRA cap at Site 32.

- Excavation with Offsite Landfilling, including removal of soil above PRGs at all four areas, with disposal in an approved Subtitle D facility.

These alternatives are initially evaluated using the three screening criteria of implementability, effectiveness, and cost. Then, as per the *National Contingency Plan* (NCP), a detailed analysis of alternatives is performed on all four alternatives, using the criteria of long-term effectiveness; short-term effectiveness; reduction of toxicity, mobility, or volume; implementability; cost; compliance with ARARs; overall protection of human health and the environment; state acceptance; and community acceptance.

The four alternatives are then compared using the nine criteria discussed above. The comparison conducted using threshold criteria (overall protection of human health and the environment and compliance with ARARs), balancing criteria (long-term effectiveness; short-term effectiveness; reduction of toxicity, mobility, or volume; implementability; and cost), and modifying criteria (state acceptance and community acceptance). The comparative analysis is discussed briefly below:

Threshold Criteria: If an industrial-use scenario is applied at OU 10 through the institutional controls alternative, no further actions are required to protect human health. If a residential-use scenario is applied, both the capping and excavation with offsite disposal alternatives are protective of human health. If the FDEP *Soil Cleanup Goals for Military Sites* are considered applicable to OU 10, the capping and excavation with offsite disposal alternatives are both protective of groundwater. If the leachability study determines site soil is contributing significantly to groundwater contamination, soil will be excavated and disposed offsite.

Balancing Criteria: If an industrial-use scenario is applied at OU 10 through the institutional controls scenario, no further actions are required to protect human health. If residential and leachability issues are considered, capping and excavation with offsite landfilling provide more long-term effectiveness than no-action controls; the institutional controls alternative relies on excavation and disposal as a contingency remedy if site soil poses unacceptable risks to groundwater. Short-term impacts from capping and excavation with offsite landfilling alternatives are minimal. All alternatives are implementable, and costs are all within the same order of magnitude.

Modifying Criteria: These criteria will be addressed during the FFS review period and the public comment period for the ROD.

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ACRONYMS

ARARs	Applicable or Relevant and Appropriate Requirements
BEHP	Bis(2-ethylhexyl)phthalate
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cm/sec	Centimeters per second
COCs	Chemicals of concern
CY	Cubic Yard
FDEP	Florida Department of Environmental Protection
FDER	Florida Department of Environmental Regulation
FFS	Focused Feasibility Study
ISDBs	Industrial Sludge Drying Beds
IWTP	Industrial Wastewater Treatment Plant
LF	Linear Foot
MCLs	Maximum Contaminant Levels
mg/kg	Milligrams per kilogram
mg/L	Milligrams per liter
NAS	Naval Air Station
NCP	National Contingency Plan
O&M	Operations and maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAHs	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PPE	Personal Protective Equipment
PRGs	Preliminary Remediation Goals
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
ROD	Record of Decision
SWMU	Solid Waste Management Unit
SY	Square Yard
TBC	To Be Considered
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

1.1 Purpose and Organization

The purpose of this Focused Feasibility Study (FFS) is to develop, evaluate, and compare remedial action alternatives that may be used to mitigate hazards and threats to human health and the environment as a result of soil contamination at Operable Unit 10 (OU 10), at Naval Air Station (NAS) Pensacola. This FFS addresses soil alternatives only; groundwater is addressed as per recommendations in the *Final Remedial Investigation Report, Naval Air Station Pensacola, Operable Unit 10 and Site 13* (EnSafe/Allen & Hoshall, September 1995) (RI).

This FFS is being performed under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the Superfund Amendments and Reauthorization Act of 1986 based upon findings reported in the final RI.

The organization of this FFS report has been adopted from the format suggested in Office of Solid Waste and Emergency Response (OSWER) Directive 9355.3-01, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (Interim Final, October 1988). Because of the limited scope of work at OU 10, an abbreviated feasibility study format was adopted, as described below:

- **Section 1, Site Background, PRGs** — This section presents background information regarding the RI, baseline risk assessment (BRA), and preliminary remediation goals (PRGs). Remedial volumes identified using PRGs are presented.

- **Section 2, Description of Remedial Alternatives** — This section presents the remedial alternatives. The remedial elements of each alternative are discussed, along with the implementability, effectiveness, and cost.

- **Section 3, Detailed Analysis of Alternatives** — This section presents the detailed analysis of alternatives as per the nine criteria outlined in the *National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule* (EPA/540/1-89/002, December 1989) (NCP) This analysis is the foundation of future decision-making for the site.

- **Section 4, Comparative Analysis of Alternatives** — This section presents a comparative analysis of alternatives. This section provides decision-makers with a concise comparative format that highlights differences between the alternatives.

1.2 Site Background

OU 10 is on Magazine Point at NAS Pensacola, in Escambia County, Florida. Magazine Point is currently used for both ordnance and munitions storage and treatment of industrial and domestic wastewater generated on station. OU 10 comprises of three sites: the former Industrial Sludge Drying Beds (ISDBs) (Site 32), Wastewater Treatment Plant Ponds (Site 33), and miscellaneous industrial wastewater treatment plant (IWTP) Solid Waste Management Units (SWMUs) (Site 35). OU 10 occupies approximately 26 acres. It is bounded on the east by Site 13, the Magazine Point Rubble Disposal Area. To the southwest lies Site 30 (Buildings 649 and 755). West of OU 10 is Site 11 (north of the Chevalier Disposal Area). The area north of OU 10 is a wooded peninsula bounded on the east by Pensacola Bay and on the west by Bayou Grande. The Magazine Point area is primarily used for IWTP operations, but also is the location of several ordnance bunkers. OU 10 is detailed on the Fort Barrancas, Florida Quadrangle, U.S. Geological Survey Topographic Map. Figure 1-1 is a location map of OU 10 and vicinity. Figure 1-2 shows OU 10 and Site 13.

Wastewater has been treated on Magazine Point since 1941 at various treatment facilities. The current facility was constructed in 1948 to process primarily domestic wastewater and was upgraded in 1971 to treat both industrial and domestic wastewater separately. Site 32, the Industrial Sludge Drying Beds, operated from 1971 until 1984. The beds were closed under the

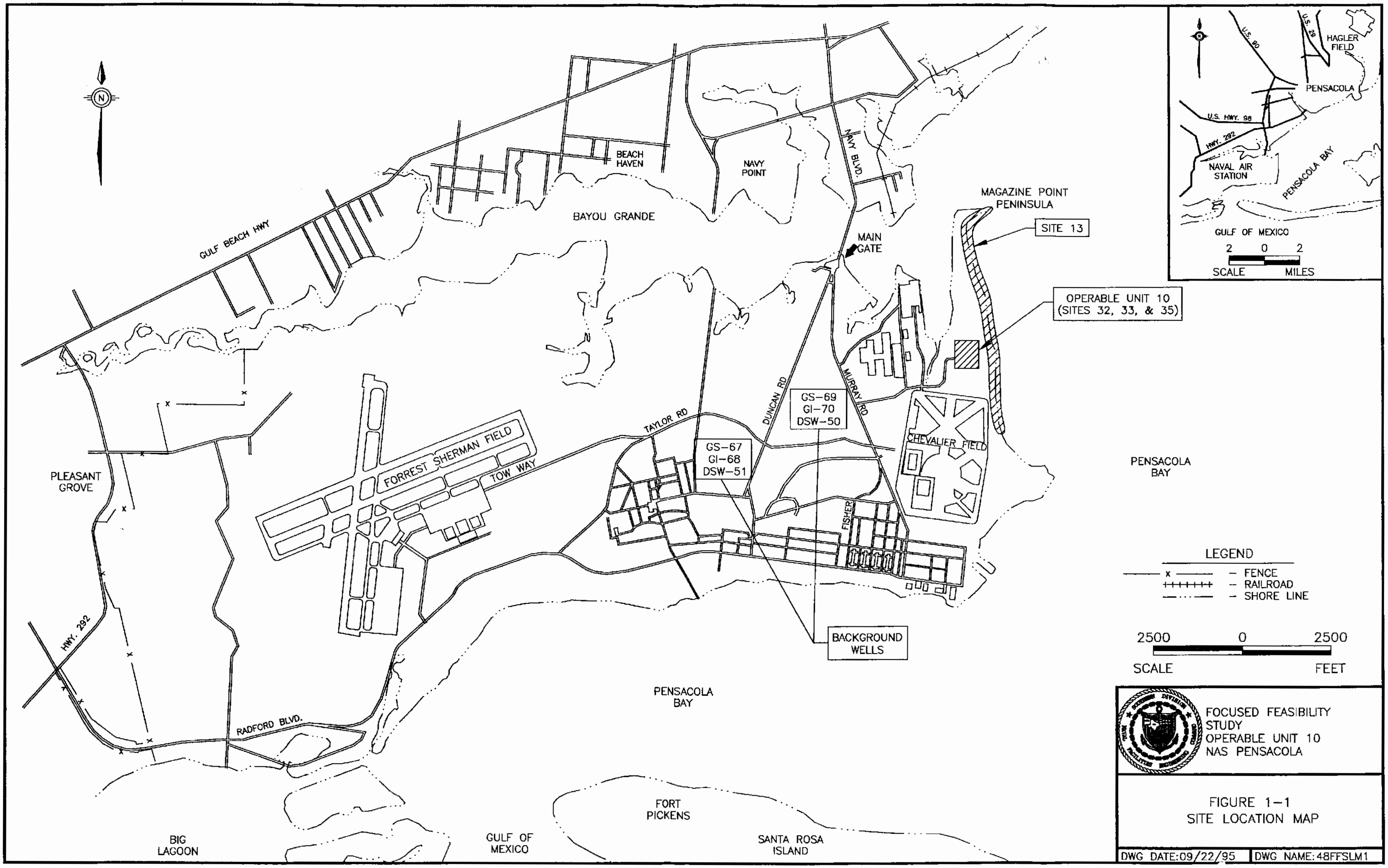
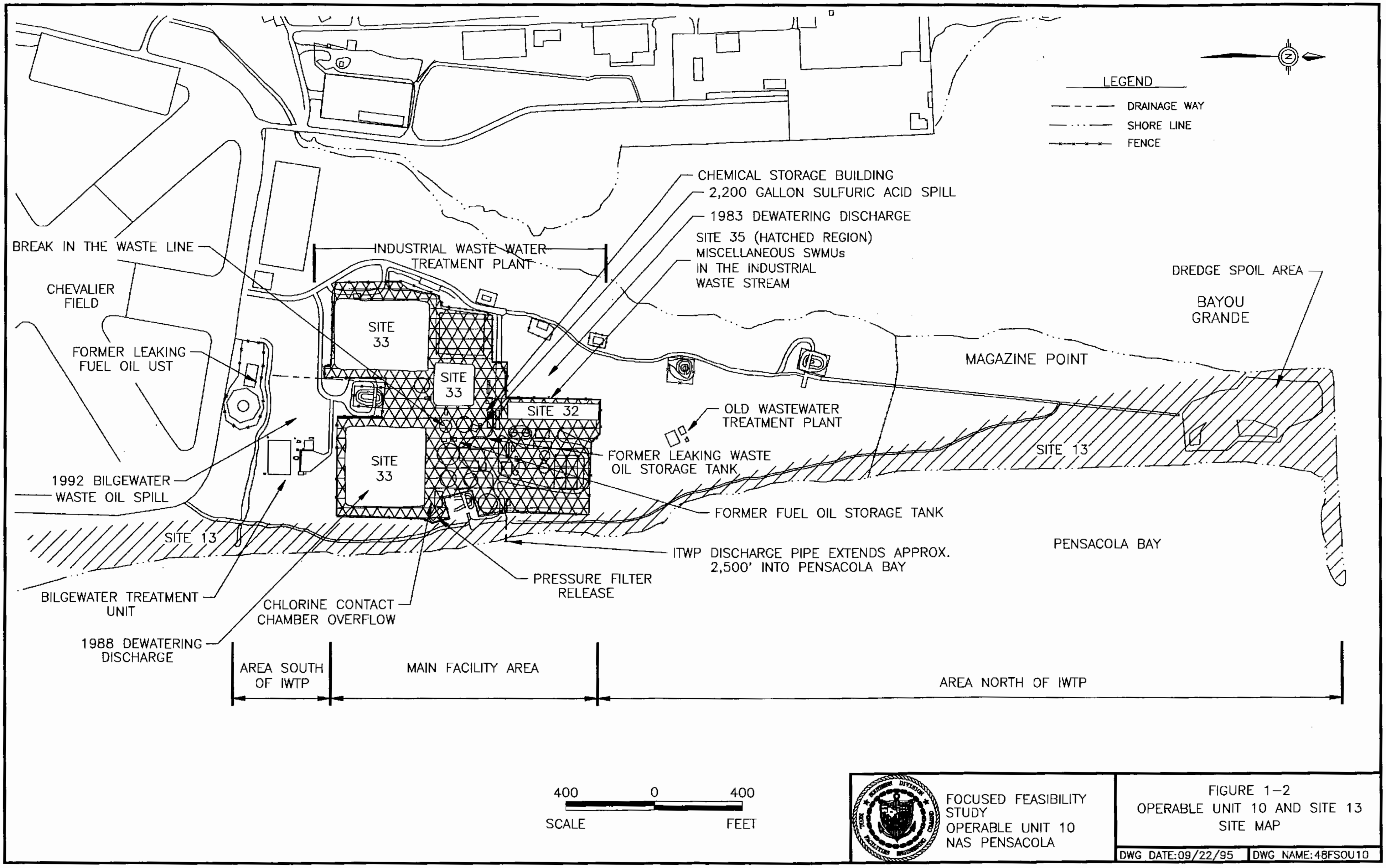


FIGURE 1-1
SITE LOCATION MAP

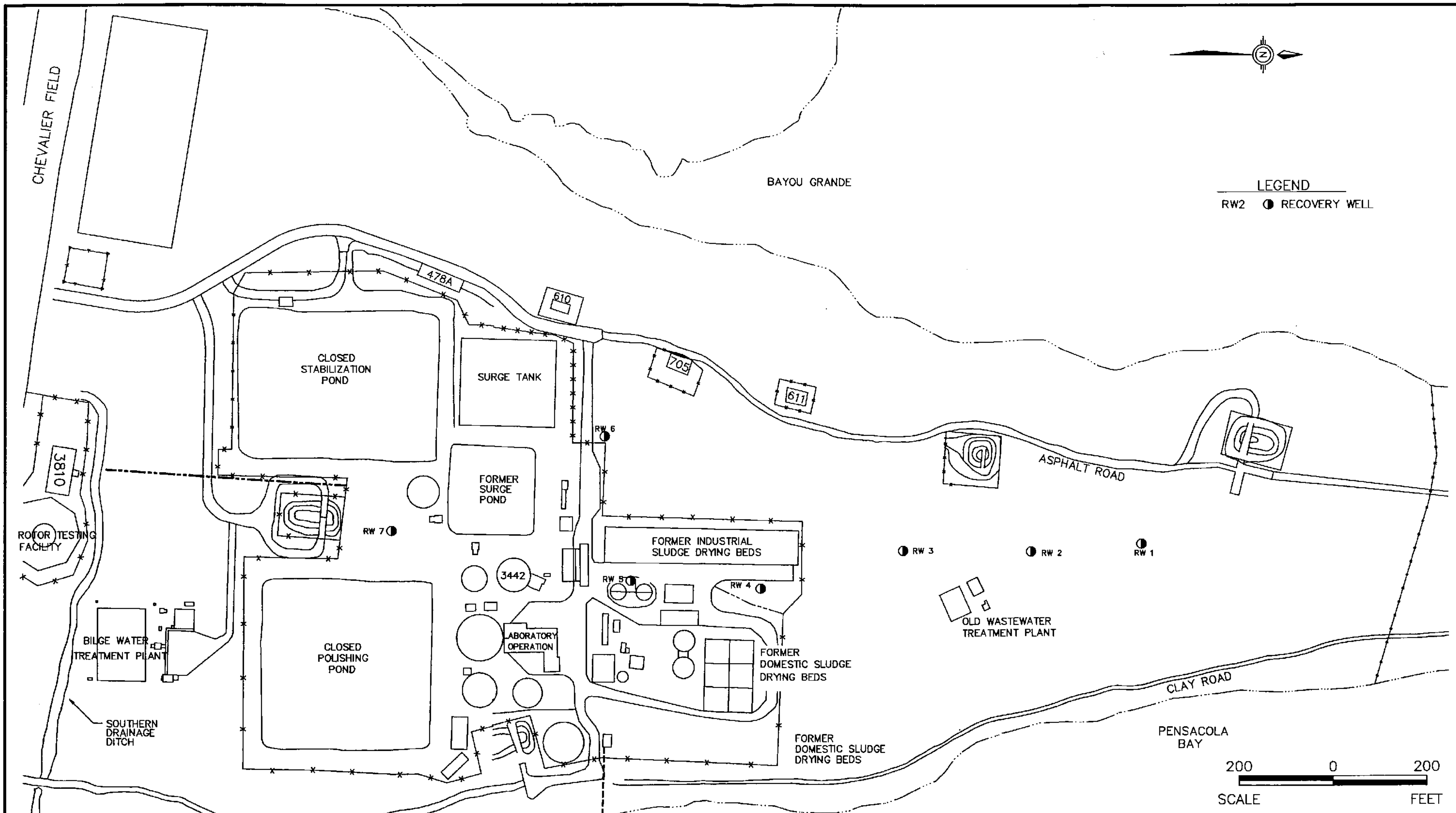

LEGEND
DRAINAGE WAY
SHORE LINE
FENCE
CHEMICAL STORAGE BUILDING
2,200 GALLON SULFURIC ACID SPILL
1983 DEWATERING DISCHARGE
SITE 35 (HATCHED REGION) MISCELLANEOUS SWMUs IN THE INDUSTRIAL WASTE STREAM
BREAK IN THE WASTE LINE
INDUSTRIAL WASTE WATER TREATMENT PLANT
CHEVALIER FIELD
DREDGE SPOIL AREA
BAYOU GRANDE
SITE 33
SITE 33
SITE 33
SITE 32
FORMER LEAKING FUEL OIL UST
MAGAZINE POINT
OLD WASTEWATER TREATMENT PLANT
SITE 13
FORMER LEAKING WASTE OIL STORAGE TANK
1992 BILGEWATER WASTE OIL SPILL
FORMER FUEL OIL STORAGE TANK
SITE 13
PENSACOLA BAY
ITWP DISCHARGE PIPE EXTENDS APPROX. 2,500' INTO PENSACOLA BAY
PRESSURE FILTER RELEASE
BILGEWATER TREATMENT UNIT
CHLORINE CONTACT CHAMBER OVERFLOW
1988 DEWATERING DISCHARGE
AREA SOUTH OF IWTP
MAIN FACILITY AREA
AREA NORTH OF IWTP
400
0
400
SCALE
FEET
FOCUSED FEASIBILITY STUDY
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 1–2
OPERABLE UNIT 10 AND SITE 13
SITE MAP
DWG DATE:09/22/95
DWG NAME:48FSOU10

Resource Conservation and Recovery Act (RCRA) in 1989. Site 32 is on the northern half of OU 10. Site 33, the IWTP Ponds, makes up the southern half of OU 10. It consists of the former Surge Pond, Phenol Stabilization Pond, and Polishing Pond, all of which operated from 1971 until 1988, when they were closed under RCRA. Both Site 32 and Site 33 are known sources of both soil and groundwater contamination at OU 10. Site 35 comprises miscellaneous IWTP SWMUs, including all industrial treatment units within the OU 10 boundary.

More detailed information regarding site use and history is presented in the final RI.

The final RI identified semivolatile, pesticide, polychlorinated biphenyl (PCB), and inorganic constituents in site soil. Constituent concentrations were relatively low, typically in the part-per-billion range; this, in conjunction with the ubiquitous distribution of most constituents, suggests constituent origins include routine pest and dust control applications using pesticides and PCBs, and natural occurrence for inorganics. Semivolatile concentrations may reflect ambient conditions related to air traffic over NAS Pensacola. Areas with higher concentrations of semivolatiles and selected inorganics appear to be isolated soil "hot spots" adjacent to former IWTP units.

A RCRA Corrective Action Program was implemented at the IWTP in 1986 to comply with conditions in the Florida Department of Environmental Regulation (FDER, since renamed) Temporary Operating Permit Number HT17-68087. A groundwater system for recovery of volatile organic compounds was installed in the shallowest portions of the underlying aquifer system. This system began operating in February 1987. Seven recovery wells were placed along the north-south axis of Magazine Point to create a composite cone of depression to capture constituents originating at the Surge Pond. Extracted groundwater was treated at the IWTP. Recovery wells are shown in Figure 1-3.



FOCUSED FEASIBILITY STUDY
OPERABLE UNIT 10
NAS PENSACOLA

FIGURE 1–3
EXISTING RECOVERY WELLS

DWG DATE:09/22/95 | DWG NAME:48FSERW3

The final RI identified volatile, semivolatile, pesticide, and inorganic compounds in site groundwater. Of these, 11 compounds exceed primary maximum contaminant levels (MCLs), three exceed secondary MCLs, and four exceed Florida guidance concentrations for organoleptic contaminants and systemic toxicants. The RI indicates that the main area of groundwater contamination (i.e., beneath Site 32) is downgradient of the existing system. The Navy will be required to notify the RCRA regulating authority of possible deficiencies and present recommendations for compliance with the current closure permit (Title 40 Code of Federal Regulations [CFR] Part 264.100). Such recommendations may include modifying the existing configuration of recovery wells, renovating wells to increase yields, or adding supplemental wells along the eastern edge of the plume. Given that the Navy will be required to modify the closure plan and correct deficiencies in the recovery system according to permit conditions, the final RI recommended that all further groundwater remedial actions be implemented under the RCRA program.

1.3 Remedial Objectives

In developing remedial objectives, four items are typically reviewed:

- The spatial distribution of contamination, as presented in the RI.
- BRA, including human health and ecological assessments.
- Chemical-specific applicable or relevant and appropriate requirements (ARARs).
- Potential groundwater contamination by contaminant residuals in site soil.

1.3.1 RI Assessment

As mentioned briefly above, the spatial distribution of constituents at OU 10 varies with media. Soil contamination is widely scattered, with the highest concentrations present in Site 32. Sites 33, 35, and 13 are characterized by isolated detections of chemicals of concern (COCs) at concentrations one to two orders of magnitude less than Site 32. Shallow and intermediate groundwater contamination exceeding MCLs is concentrated in the east-central portion of

OU 10, beneath Site 32. Little to no contamination was quantified in other areas or in the deep groundwater beneath the site.

The RI recommends no further action for Site 13. The RI also recommends that all further actions for groundwater be implemented under the existing RCRA program.

1.3.2 BRA

The BRA was reviewed to identify any site COCs in contaminated media posing risk or hazard in current or future use scenarios. Three media were assessed for human health concerns in this BRA: site surface soil, groundwater, and site sediments. Groundwater, as discussed above, will be addressed under the existing RCRA program.

- **Surface Soil** — Using screening procedures, the final BRA determined that no Site 13 soil constituent warranted formal exposure assessment or risk characterization; full assessment and characterization was conducted at OU 10. No risks above $1x10^{-6}$ are posed to current or future site workers under an industrial scenario. However, the BRA identifies two constituents in site surface soil contributing risk greater than $1x10^{-6}$ to a future resident child: benzo(a)pyrene and dibenz(a,h)anthracene. The BRA notes that risk from these compounds is driven by a single sampling location in Site 32. If this point is excluded from BRA calculations, there are no risks from these two compounds above the $1x10^{-6}$ threshold. Site surface soil COCs do not contribute to exposures above a hazard quotient of 1.0 under any exposure scenario.

- **Sediment** — The only compound contributing risk from site sediments is arsenic. This compound may be naturally occurring in marine environments, as discussed in the final RI.

The ecological risk assessment did not quantify any risk/hazard to terrestrial organisms from groundwater, surface water, or sediments, as discussed in the final RI.

1.3.3 Chemical-Specific ARARs and TBCs

Where appropriate, chemical-specific ARARs will be considered in developing remedial objectives for the site. As per the NCP, the BRA provides site-specific risk-based remedial cleanup goals which may be considered ARARs for the site. The Florida Department of Environmental Protection (FDEP) *Soil Cleanup Goals for Military Sites* (discussed below) are "to be considered" (TBC) criteria for the site. Other chemical-specific ARARs which might impact the selection and screening of technologies include characteristic hazardous waste designations and land-ban criteria. These will be considered when discussing technologies, if appropriate.

The actual determination of which requirements are applicable or relevant and appropriate is made by the lead agency in consultation with the support agencies. Waivers must be obtained for alternatives which are selected but do not comply with established ARARs, as per CERCLA 121(d)(4).

1.3.4 Protection of Groundwater Assessment

The potential for groundwater contamination due to site COCs was also assessed by comparing constituent concentrations in soil with guidance concentrations protective of groundwater (as identified in FDEP's *Soil Cleanup Goals for Military Sites*). As discussed above, these concentrations are TBC criteria for the site. Nineteen COCs were identified as exceeding guidance concentrations when soil concentrations were compared to the leaching criterion:

Type A	***Type B***	***Type C***
Chlorobenzene	Xylene	Benzo(a)pyrene
1,2-Dichlorobenzene	Phenol	Phenanthrene
1,3-Dichlorobenzene	Acenaphthene	Pentachlorophenol
1,4-Dichlorobenzene	Dieldrin	Bis(2-chloroethyl)ether
Bis(2-ethylhexyl)phthalate (BEHP)	Endosulfan	
Naphthalene	Acetone	
	DDE	
	DDT	
	Alpha-BHC	

Type A constituents were defined as those exceeding Florida guidance concentrations for leachability in soil and promulgated MCLs or Florida guidance concentrations in groundwater. Type A compounds in groundwater (except BEHP) are concentrated beneath and east (downgradient) of Sites 32 and 33; these compounds are targeted by the RCRA groundwater recovery system, as they were present in RCRA units at Sites 32 and 33. Soil containing these compounds (with the exception of BEHP) is adjacent to or east of Sites 32 and 33. Because of this, it is not possible to distinguish between groundwater contamination attributable to soil contamination or the former RCRA units. For this reason, FDEP leachability-based guidance concentrations for Type A constituents have been retained as site COCs for development of PRGs. (BEHP, a common laboratory contaminant, is not expected to be present in site soil, and therefore has not been retained as a site COC.)

Type B compounds were present in both soil and groundwater. They exceeded Florida guidance concentrations for leachability in soil, but were below MCLs or Florida guidance concentrations in groundwater. Type B compounds are present in soil above FDEP guidance concentrations at various locations at OU 10, primarily single-boring detections; contaminant mass associated with these detections is expected to be low. The spatial distribution of Type B compounds in groundwater does not necessarily correlate with soil borings containing soil contamination above FDEP leachability-based guidance concentrations. However, groundwater contamination associated with these compounds is also concentrated primarily beneath Site 32, and is being addressed by the existing RCRA groundwater recovery system. Because groundwater monitoring is required as part of the RCRA groundwater recovery program, Type B constituents were not included in developing site-specific PRGs.

Type C compounds were present in soil at concentrations exceeding Florida guidance concentrations for leachability in soil, but not detected in groundwater. The spatial distribution of Type C compounds in soil above FDEP guidance concentrations is limited to primarily single-boring detections; contaminant mass associated with these detections is expected to be low. Because these compounds are not impacting groundwater, and ongoing groundwater monitoring is required as part of the RCRA groundwater recovery program, these compounds were not included in developing site-specific PRGs.

The State of Florida considers these TBC criteria applicable to the OU 10 site.

1.3.5 Remedial Objectives

If an industrial scenario is applied at OU 10, no further action is required to protect human health. However, to address a potential residential scenario at OU 10, preliminary contaminant-specific remedial goals for soil that protect future residents are presented in Table 1-1. Table 1-1 also presents PRGs included based on FDEP leachability-based guidance concentrations; these PRGs represent soil concentrations protective of groundwater (i.e., protective of MCLs or FDEP groundwater guidance concentrations). Groundwater is not being considered in this FFS, as the RI recommended all further groundwater actions be implemented under the active RCRA program.

At OU 10, soil contamination from compounds identified in Table 1-1 was present in three locations near Site 32 and one location at Site 35. These locations, and associated COCs, are shown in Figures 1-4 and 1-5.

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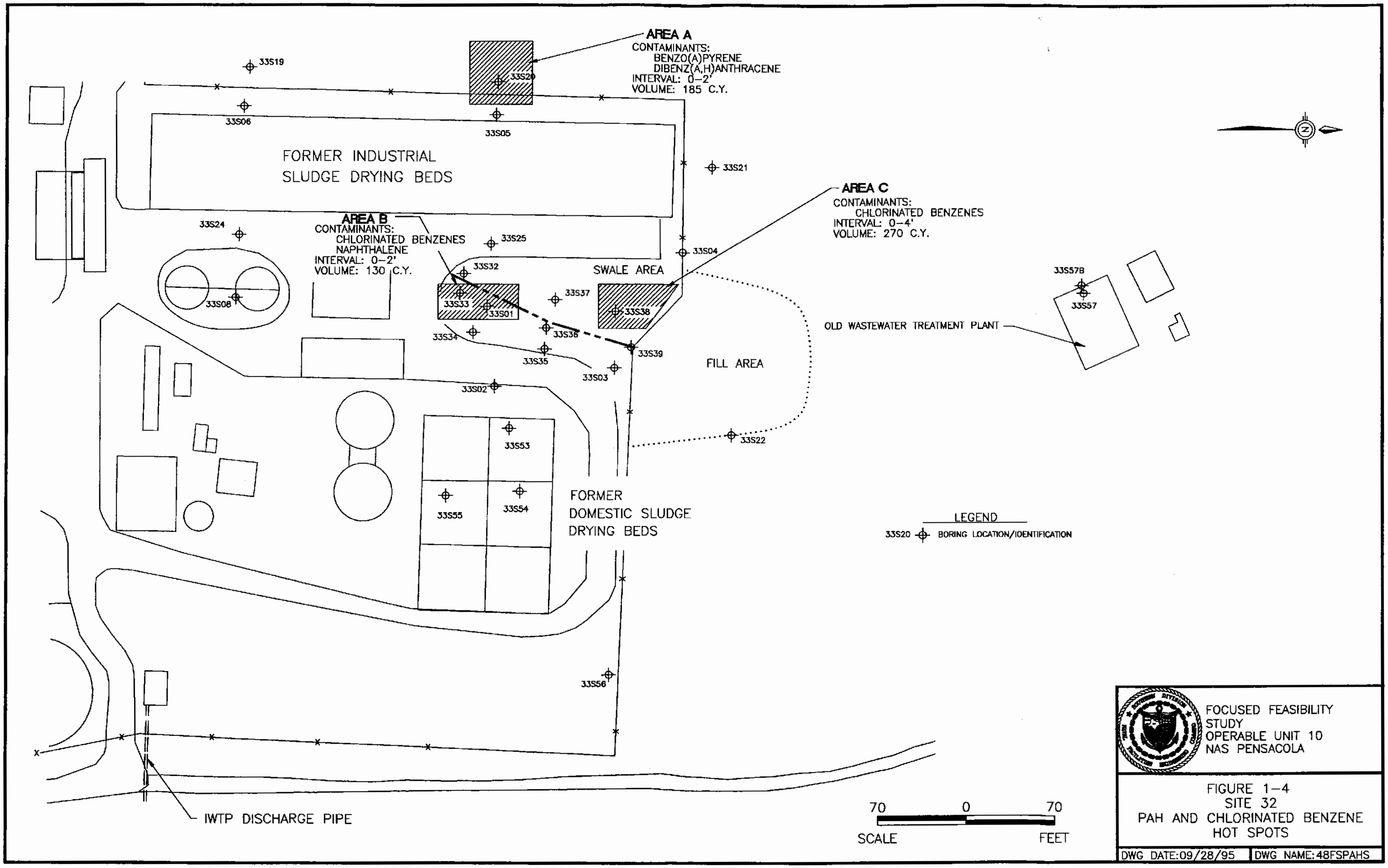

AREA A
CONTAMINANTS:
BENZO(A)PYRENE
DIBENZ(A,H)ANTHRACENE
INTERVAL: 0–2'
VOLUME: 185 C.Y.
AREA B
CONTAMINANTS:
CHLORINATED BENZENES
NAPHTHALENE
INTERVAL: 0–2'
VOLUME: 130 C.Y.
AREA C
CONTAMINANTS:
CHLORINATED BENZENES
INTERVAL: 0–4'
VOLUME: 270 C.Y.
FORMER INDUSTRIAL SLUDGE DRYING BEDS
SWALE AREA
FILL AREA
OLD WASTEWATER TREATMENT PLANT
FORMER DOMESTIC SLUDGE DRYING BEDS
IWTP DISCHARGE PIPE
33S19
33S20
33S06
33S05
33S21
33S24
33S25
33S04
33S32
33S08
33S33
33S01
33S37
33S38
33S36
33S34
33S35
33S39
33S03
33S02
33S53
33S22
33S55
33S54
33S56
33S57B
33S57
LEGEND
33S20 BORING LOCATION/IDENTIFICATION
70 0 70
SCALE FEET
FOCUSED FEASIBILITY STUDY
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 1–4
SITE 32
PAH AND CHLORINATED BENZENE HOT SPOTS
DWG DATE: 09/28/95
DWG NAME: 48FSPAHS

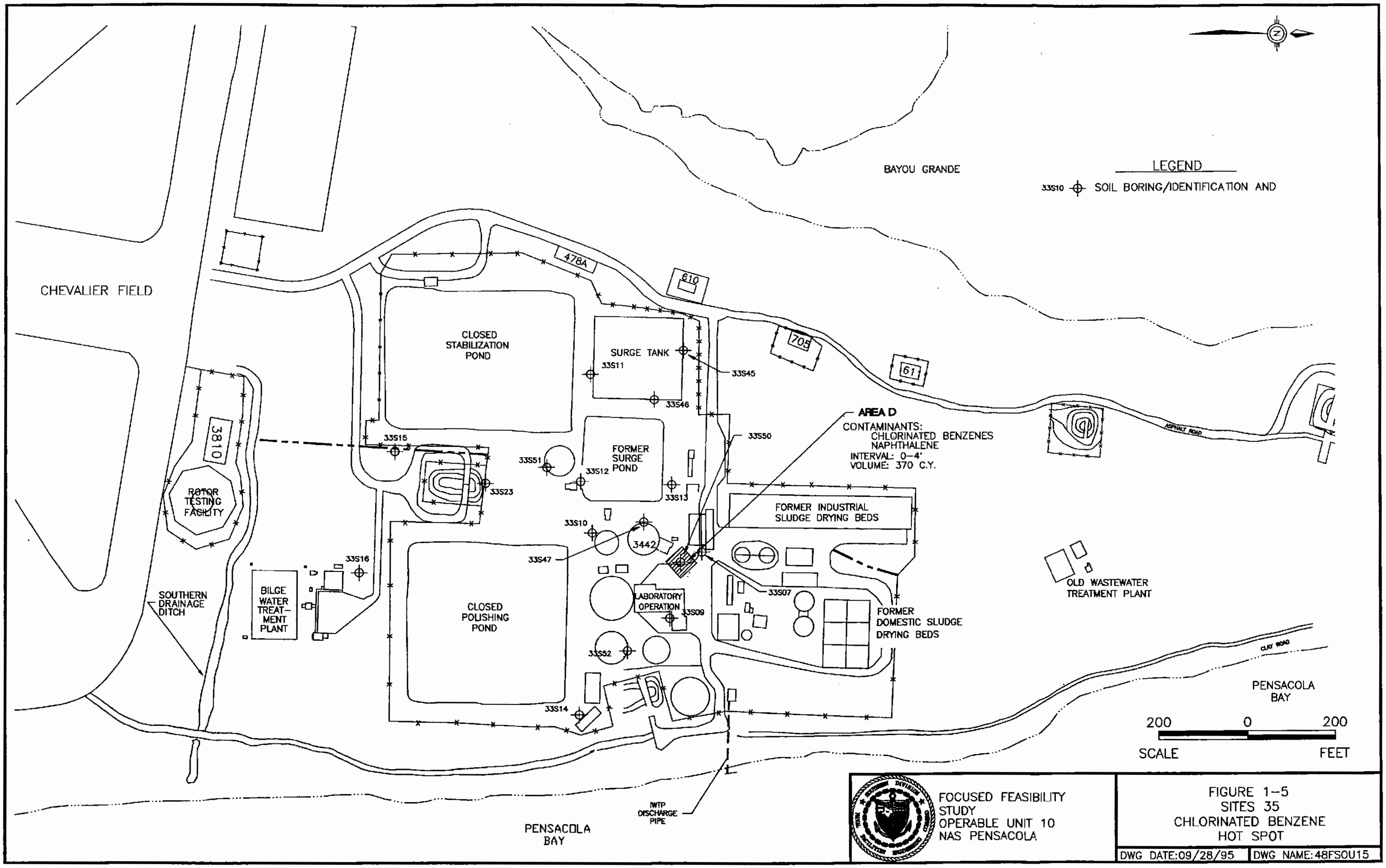
LEGEND
33S10 SOIL BORING/IDENTIFICATION AND
BAYOU GRANDE
CHEVALIER FIELD
CLOSED STABILIZATION POND
SURGE TANK
33S11
33S45
33S46
3810
ROTOR TESTING FACILITY
33S15
33S51
FORMER SURGE POND
33S12
33S23
33S13
33S50
AREA D
CONTAMINANTS:
CHLORINATED BENZENES
NAPHTHALENE
INTERVAL: 0-4'
VOLUME: 370 C.Y.
FORMER INDUSTRIAL SLUDGE DRYING BEDS
33S10
3442
33S47
33S16
SOUTHERN DRAINAGE DITCH
BILGE WATER TREAT-MENT PLANT
CLOSED POLISHING POND
LABORATORY OPERATION
33S09
33S07
FORMER DOMESTIC SLUDGE DRYING BEDS
OLD WASTEWATER TREATMENT PLANT
33S52
33S14
478A
610
705
611
ASPHALT ROAD
CLAY ROAD
PENSACOLA BAY
IWTP DISCHARGE PIPE
PENSACOLA BAY
200 0 200
SCALE FEET
FOCUSED FEASIBILITY STUDY
OPERABLE UNIT 10
NAS PENSACOLA
FIGURE 1-5
SITES 35
CHLORINATED BENZENE
HOT SPOT
DWG DATE:09/28/95
DWG NAME:48FSOU15

Table 1-1
Preliminary Contaminant-Specific Remediation Goals for Soil at OU 10

Compound	PRG (μg/kg)	ARAR or TBC	Number of Exceedances	Basis
Benzo(a)pyrene	1,300	ARAR	1	Risk-based criterion (BRA).
Dibenz(a,h)anthracene	1,300	ARAR	1	Risk-based criterion (BRA).
Chlorobenzene	600	TBC	1	Florida guidance — leachability.
1,2-Dichlorobenzene	5,800	TBC	3	Florida guidance — leachability.
1,3-Dichlorobenzene	400	TBC	4	Florida guidance — leachability.
1,4-Dichlorobenzene	900	TBC	4	Florida guidance — leachability.
Naphthalene	100	TBC	3	Florida guidance — leachability.

Area A contains primarily polynuclear aromatic hydrocarbon (PAH) compounds, and is the only area that requires remediation due to BRA goals. Although surrounding data points are not present, this location is assumed to be a hot spot with dimensions of 50 feet by 50 feet; the contaminated interval is 0 to 2 feet in depth. This volume was selected for use in evaluating technologies. The actual volume may differ and should be refined using confirmation sampling during the removal.

Areas B and C, in the swale area, were identified for remediation due to chlorinated benzenes and naphthalene present above Florida leachability-based guidance concentrations. Volumes were quantified using outer sampling points to estimate extent boundaries.

Area D, adjacent to the primary operations area, is near an old tank pit. The actual extent of contamination is not known; this location is assumed to be a hot spot with area dimensions of 50 feet by 50 feet, and a total depth of 4 feet. Constituents in this areal are primarily chlorinated benzenes and naphthalene.

Table 1-2 presents remedial objectives developed from the analysis of soil PRGs described above:

Table 1-2
OU 10 — Soil Remedial Objectives

Objective	**Location**	**Contaminated Media** **Estimated Volume (CY)**	**Rationale**
Eliminate human health risk above $1x10^{-6}$.	33S20 — West of the closed ISDBs.	185	Benzo(a)pyrene and dibenz(a,h) anthracene above risk levels (ARAR).
Protect groundwater from leachable compounds.	33S01 and 33S33 — Swale 33S38 — Swale 33S50 — North of operations building.	130 270 370	Chlorinated benzenes and naphthalene above guidance concentrations (TBC).

Note:

CY — Cubic yards

1.4 Preliminary Technology Screening

Remedial technologies applicable to chlorinated benzenes and PAHs in soil vary significantly with respect to site-specific conditions. The following remedial process options were considered for OU 10, given site soil conditions and depth to groundwater.

- Institutional controls
- Onsite capping
- Excavation
- Offsite landfilling
- Offsite incineration
- Onsite biodegradation

Table 1-3 discusses these treatment technologies and their objectives, along with implementability, effectiveness, and cost issues. The following table is consistent with technology screening techniques presented in the NCP and U.S. Environmental Protection Agency (USEPA) guidance, because it includes containment, removal, disposal, and treatment

Table 1-3
Remedial Process Option Screening for OU 10

Remedial Process Options	Objectives	Implementability	Effectiveness	Cost
Institutional Controls	Institutional controls are process options used to restrict future land use or access to a site. The objective of institutional controls is to eliminate exposure pathways (e.g., dermal contact risks).	This option is implementable at OU 10. An addendum to the NAS Pensacola Master Plan can be submitted restricting future land use on Magazine Point.	This technology is effective in reducing contact, ingestion, or inhalation risks. Institutional controls can be enforced onsite through current security procedures.	None.
Capping	Capping is a containment technology which will limit human contact with soil and reduce infiltration of rainwater through contaminated zones. There are currently two RCRA caps at OU 10, one asphalt and one clay.	This technology is implementable at OU 10; there are currently two RCRA caps managed onsite. Asphalt capping may be preferred to support and maintain current activities. Underground utilities that cannot be moved must be incorporated into the design.	This technology is effective at reducing contact, ingestion, or inhalation risks. Capping also significantly reduces leachate generation by infiltrating rainwater. The cap must be maintained for at least 30 years.	Low. ($20 to $30/square yard [SY])
Excavation	Excavation is a removal technology. Excavation of contaminated areas eliminates future risks to human health and the environment. A disposal method will be required for excavated soil.	This technology is readily implementable at OU 10. Hot spot locations are readily accessible; volumes will be relatively easy to manage. Excavation activities will need to address underground utilities. If the water table is seasonally high, some dewatering may be required to achieve full volume removal.	This technology is very effective at removing contaminated media. Risks to human health and the environment are eliminated. A disposal method will be required for excavated soil.	Low. ($20/CY)

Table 1-3
Remedial Process Option Screening for OU 10

Remedial Process Options	Objectives	Implementability	Effectiveness	Cost
Offsite Landfilling	Landfilling excavated materials in a secured, approved landfill provides containment and affords protection to human health and the environment. Pretreatment may be required before landfilling.	This technology is readily implementable at many offsite facilities. Although inorganic constituent concentrations do not suggest that pretreatment due to land disposal restrictions will be necessary, solidification/ stabilization is readily available at several permitted facilities.	This technology is effective at containing contaminated media in a permitted landfill. Risks to human health and the environment onsite are eliminated.	Low to medium. ($50/CY)
Offsite Incineration	Offsite incineration treats contaminated soil using thermal destruction. Incineration is protective of human health and the environment and satisfies statutory preference for treatment. Residuals are landfilled.	This technology is readily implementable at many offsite facilities. However, constituent concentrations are relatively low, and there is no technical reason or regulatory requirement for incineration before disposal. Inorganic constituents present in site soil may be undesirable in incinerator feedstock or residuals.	This technology is effective at destroying organic constituents in environmental media. Risks to human health and the environment onsite are eliminated.	High. ($1,000/CY)
Onsite Biodegradation	Onsite biodegradation treats contaminated soil using natural or cultured microbial populations. Biodegradation could occur in-or ex-situ. If complete mineralization of constituents is achieved, it is protective of human health and the environment, and satisfies statutory preference for treatment.	This technology is implementable onsite; however, due to the small volumes of waste present onsite it may not be cost-effective to conduct treatability studies on microbial activity. Ex-situ remediation may interfere with current and future activities. In-situ remediation, supported by flushing or nutrient supplementation, may adversely impact the water table or groundwater quality.	While this technology may be very applicable to PAHs and other semivolatiles, the effectiveness of bioremediation at OU 10 is questionable. High concentrations of inorganics in site soil may be toxic to microbes. Soil heterogeneity, particularly in the swale area, may inhibit uniform treatment of contamination. Microbes may not be able to achieve the very low PRGs for site constituents.	Unknown.

technologies. The implementability, effectiveness, and cost criteria are discussed as per USEPA guidance.

Using the implementability, effectiveness, and cost criteria discussed in this table to screen remedial technologies, it is clear that offsite incineration is not required for either technical or regulatory reasons; in addition, incineration is a prohibitively expensive treatment option. Incineration will not be included in the assembly of alternatives. Similarly, bioremediation of contaminated soil is not required for technical or regulatory reasons. Other incidental constituents present in site soil (chromium, for example) may hinder active bioremediation of primary constituents. Given the unknowns regarding the effectiveness of this technology, soil volumes do not justify the costs of treatability study or onsite bioremediation activities. Onsite bioremediation will not be retained for the assembly of alternatives.

Institutional controls, capping, excavation, and landfilling all satisfy the implementability, effectiveness, and cost criteria; these process options will be retained for the assembly of alternatives.

1.5 Focused Feasibility Study Alternatives

As described in the NCP, the primary objective of the feasibility study is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to decision-makers and the appropriate remedy selected. To accomplish this objective, the feasibility study is tasked with addressing only remedial measures appropriate to the scope and complexity of the project.

Because soil remediation objectives are clearly defined and soil volumes are relatively small (less than 1,000 cubic yards [CY]), the FFS format will be used to address media of concern. Three remedial alternatives will be discussed.

- **Alternative 1 — No Action.** This alternative is required under the NCP. Under the no-action alternative, contaminated soil media will be left in place. This alternative would pose no risk to current workers and site trespassers; risk to future child residents slightly exceeds the $1x10^{-6}$ threshold. While contaminated soil may continue to leach constituents to groundwater, it is expected that soil concentrations are attenuating with time and that current soil conditions represent worst-case scenarios over the next 30 years. Contaminated groundwater will be contained and treated by the RCRA recovery system. This alternative incorporates soil and groundwater monitoring once every five years as per the NCP; data will be evaluated to monitor the status of site contaminants.

- **Alternative 2 — Institutional Controls.** Under the institutional controls alternative, future land use at OU 10 and Magazine Point would be restricted to industrial use. Future land use restrictions and controls would be described in the NAS Pensacola Master Plan. This would prohibit Magazine Point from being used for residential purposes, therefore eliminating all risks to future child residents. Under this alternative, contaminated soil would be left in place. This alternative would pose no risk to current workers and site trespassers. A leachability study would be conducted to determine if chlorinated benzenes and naphthalene were contributing significantly to groundwater contamination. If leachate contributions to groundwater were deemed unacceptable, contaminated soil would be excavated as discussed below in Alternative 4. Contaminated groundwater will be contained and treated by the existing RCRA recovery system.

- **Alternative 3 — Capping.** Asphalt-paved areas are adjacent to all four areas of contamination described in Table 1-2. This alternative would extend the asphalt pavement into the swale area, in the operations building area, and west of the fenceline adjacent to the ISDBs. Storm water runoff controls may be required. This alternative would pose no risk to current workers and site trespassers; risk to future child residents, assuming potential cap failure, slightly exceeds the $1x10^{-6}$ threshold. The primary benefit in this alternative is reduced leachate generation and infiltration into groundwater. Contaminated groundwater will be contained and treated by the RCRA recovery system.

- **Alternative 4 — Excavation.** Hot-spot excavation can be performed in the four areas identified in Table 1-2. Excavated soil could be disposed offsite in an approved Subtitle D facility. This alternative would eliminate risk to future child residents and would remove soil threatening groundwater. The RCRA system would still be operational as per facility permit conditions, containing and treating contaminated groundwater.

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2.0 ASSEMBLY OF ALTERNATIVES

This section presents remedial alternatives developed using residential-, industrial-, and leachability-based PRGs. The remedial elements of each alternative are discussed, along with impacts on the community, associated costs, and implementation considerations.

2.1 Alternative 1: No Action

The NCP requires consideration of a no-action alternative. In the no-action alternative, no remedial actions will be taken to contain, remove, or treat soil contaminated above risk- or leachability-based cleanup goals. Soil will remain in place and will attenuate according to natural biotic or abiotic processes. Alternative 1 differs significantly from a "no-further-action" alternative; soil and groundwater monitoring is incorporated to assess site status once every five years.

2.1.1 Alternative 1: Remedial Elements

No remedial elements are associated with the no-action alternative. Soil monitoring may be required once every five years to assess risks to human health and the environment from contaminated soil. Monitoring actions may include soil and groundwater sampling, as described below:

- Area A: Soil sampling to determine whether natural attenuation has reduced constituent concentrations below risk-based concentrations.

- Areas B, C, and D: Soil sampling to determine whether natural attenuation has reduced constituent concentrations below leachability-based concentrations. Groundwater sampling beneath each area to determine if constituent concentrations in groundwater have increased.

2.1.2 Alternative 1: Implementability

This alternative is technically feasible. No construction, operation, or maintenance is required. No technology-specific regulations apply.

This alternative is administratively feasible. The no-action alternative has no special technical or capacity requirements.

2.1.3 Alternative 1: Effectiveness

The no-action alternative does not provide any additional effectiveness for the current use scenario as no risks to current or future workers are posed above the 1×10^{-6} threshold. The site is secured by Navy personnel; unauthorized personnel are not allowed near OU 10. This alternative does not meet the effectiveness criterion as it does not reduce future child exposures to benzo(a)pyrene and dibenz(a,h)anthracene.

The no-action alternative also does not meet the effectiveness criterion for protection of groundwater as it does not reduce the leachability of chlorinated benzenes. However, although potentially leachable soil is left in place, a RCRA groundwater containment/recovery system is operating onsite. Due to the age of site constituents, it is unclear whether current volumes of soil contaminated with leachable compounds will significantly impact the aquifer any more than the current scenario. Constituent concentrations in Areas B, C, and D are expected to decrease through natural biotic or abiotic attenuation processes, thus rendering the soil less threatening to groundwater with time.

This alternative does not reduce the toxicity, mobility, or volume of contaminants. No risks are posed during the short term (implementation phase). Once the no-action alternative is implemented, the only risks remaining are those to future child residents; soil contaminated with chlorinated benzenes above concentrations presented in Table 1-1 may threaten site groundwater.

2.1.4 Alternative 1: Cost

Cost components for the no-action alternative include the following:

- Soil sampling
- Groundwater sampling
- Analysis and report compilation

Costs associated with soil and groundwater sampling once every five years are detailed in Table 2-1. Total costs for groundwater sampling are approximately $43,000 per event. Once again, Alternative 1 differs from a "no-further-action" alternative: monitoring is the primary remedial element and incurs cost.

Table 2-1
Soil and Groundwater Monitoring Costs Per Event

Action	Quantity	Cost per Unit	Total Cost
Soil Sampling	3 borings per area, for a total of 12 borings, completed to a depth of 4 feet below ground surface	$370/boring	$4,440
Groundwater Sampling	Area A — no wells, cleanup based on human health risk Area B — 33G01 Area C — 33G09 Area D — 33G02	$370/well	$1,110
Soil Sample Analysis	2 samples per borehole, for a total of 24 samples	$1,100/sample	$26,400
Groundwater Sample Analysis	1 sample per well, for a total of 3 samples	$1,100/sample	$3,300
Travel/Lodging	5 days travel and lodging for 2 people	$2,000 travel for 2 people $200 per day for 2 people	$3,000
Report Preparation	2 weeks	$2,440/week	$4,880

Notes:

Sampling costs assume 2 people onsite; soil samples obtained using hand augers; groundwater samples obtained using bailers or peristaltic pumps.

Costs do not include quality assurance/quality control samples.

2.2 Alternative 2: Institutional Controls

The institutional controls alternative would zone the OU 10 area for industrial use only and prohibit Magazine Point from being used for residential purposes in the future. A leachability study would be conducted to demonstrate that chlorinated benzenes and naphthalene found in site soil above Florida leachability-based guidance concentrations are not contributing significantly to groundwater contamination onsite. If leachate contributions are deemed unacceptable, soil would be excavated as per Alternative 4. The leachability study would be conducted during the remedial design/remedial action (RD/RA) period following Record of Decision (ROD) issuance. The purpose of this alternative is to eliminate risks to future child residents through land use restrictions.

2.2.1 Alternative 2: Remedial Elements

Two actions will be required for implementation of the institutional controls alternative. First, a leachability study will be conducted during RD/RA to assess the leachate generation in Areas B, C, and D. If these areas are not contributing significantly to the existing groundwater plume, an addendum to the NAS Pensacola Master Plan will be required, stating that future land use on Magazine Point will be restricted to industrial purposes.

If significant groundwater contamination is occurring due to contaminated soil, the critical areas will be excavated as described in Alternative 4.

2.2.2 Alternative 2: Implementability

This alternative is technically feasible. Soil sampling is technically feasible. No construction, operation, or maintenance is required. No technology-specific regulations apply.

This alternative is administratively feasible. No problems are anticipated in zoning the OU 10 site as an industrial area.

2.2.3 Alternative 2: Effectiveness

The institutional controls alternative meets the effectiveness criterion as it eliminates risk to future child residents. It does not provide any additional effectiveness for current and future site workers, as no risks are posed above the $1x10^{-6}$ threshold. The site is secured by Navy personnel; unauthorized personnel are not allowed near OU 10.

The institutional controls alternative assesses the leachability of chlorinated benzenes and naphthalene in site soil using a site-specific study. This study will determine any risks to the environment posed by site soil. If site soil is found to be impacting groundwater at unacceptable rates, critical areas will be excavated and disposed offsite, as described in Alternative 4.

If leachate is not found to be a threat to site groundwater, constituent concentrations in Areas A, B, C, and D are expected to decrease through natural biotic or abiotic attenuation processes.

This alternative does not reduce the toxicity, mobility, or volume of contaminants unless excavation is necessary. Similarly, no risks are posed during the short term (implementation phase) unless excavation is necessary.

2.2.4 Alternative 2: Cost

Cost components for the institutional controls alternative include the following:

- Soil sampling
- Leachability analysis and report compilation

Costs associated with the leachability study are detailed in Table 2-2. Direct costs for leachability analysis are approximately $50,000. If the leachability study determines that soil exceeding Flordia leachability-based guidance concentrations poses unacceptable threats to

Table 2-2
Leachability Study Costs

Action	Quantity	Cost per Unit	Total Cost
Soil Sampling	3 borings per area, for a total of 12 borings, completed to a depth of 4 feet below ground surface	$370/boring	$4,440
Soil Sample Analysis	2 samples per borehole, for a total of 24 samples	$1,400/sample	$33,600
Travel/Lodging	2 days travel and lodging for 2 people	$2,000 travel for 2 people $200 per day for 2 people	$2,400
Report Preparation	4 weeks	$2,440/week	$9,800

Notes:

Sampling costs assume 2 people onsite; soil samples obtained using hand augers.

Costs do not include quality assurance/quality control samples.

groundwater, additional costs will be incurred by excavating and disposing of contaminated soil. These costs are detailed for Alternative 4.

If excavation and disposal are required, total direct costs are estimated to be $90,000, excluding dewatering; dewatering will add approximately $10,000 per week. No O&M or sampling costs will be required under the contingent plan.

2.3 Alternative 3: Capping

In the capping alternative, each of the four areas outlined in Section 1.3.5 will be covered with an asphalt cap. The purpose of the caps will be twofold:

- In Area A, the cap will reduce the risk of contact with contaminated soil.

- In Areas B, C, and D, the cap will reduce the quantity of leachate generated when infiltrating rainwater comes into contact with contaminated soil.

2.3.1 Alternative 3: Remedial Elements

The caps will consist of asphalt pavement, both as extensions of the current RCRA ISDB cap (Site 32) and paved access roads and as stand-alone caps. Grubbing, grading, and fencing will be required in and adjacent to Areas A and C.

Cap construction under this alternative will consist of a base course, binder course, and topcoat. Low-permeability mix asphalt (with a permeability of $1x10^{-7}$ centimeters per second [cm/sec] or less) should be used for the upper two courses. To meet the requirements of an environmental cap, the design and construction should comply with the *Specifications for the RCRA Closure of Industrial Sludge Drying Beds and the Surge Pond* (EnSafe/Allen & Hoshall, 1988), supporting the Closure Plan for FDER Closure Permit Number HF17-134657. Regular maintenance activities will be required to maintain the cap; such activities may include patching, sealing, or re-surfacing the caps to ensure integrity.

Native materials onsite have measured permeabilities of $1x10^{-3}$ to $1x10^{-2}$ cm/sec. Asphalt capping using specifications outlined for the ISDB closure plan will reduce the surface permeability to $1x10^{-7}$ cm/sec, resulting in significantly less infiltration into contaminated soil zones.

2.3.2 Alternative 3: Implementability

This alternative is both technically and administratively feasible at OU 10.

Caps can be constructed at OU 10 by extending current pavement over areas of concern. Caps are regarded as reliable containment structures. The purpose of the caps is to isolate constituents exceeding risk and guidance concentrations in environmental media, not to manage solid or hazardous waste. Therefore, RCRA capping requirements are not applicable or appropriate to the site. However, because the intent of RCRA is to minimize leachate through contaminated areas, RCRA capping considerations will be considered relevant when completing final design for the asphalt caps. Once installed, regular maintenance will be required; however, these functions are already occurring onsite due to the asphalt cap over the ISDBs. Implementation must account for both current plant operations and future operation of the RCRA containment system (located near Areas B and C).

The capping alternative is administratively feasible at OU 10. Given the presence of two RCRA caps within the IWTP (one of which is an asphalt cap used for light-duty vehicular traffic), problems are not anticipated for the four minor caps presented in this alternative. No special services or capacity are required.

2.3.3 Alternative 3: Effectiveness

The capping alternative does not offer any additional effectiveness for current and future site workers, as no risks are posed above the 1×10^{-6} threshold. The site is secured by Navy personnel; unauthorized personnel are not allowed near OU 10. However, if the cap over Area A is maintained, this alternative will be effective in reducing future child exposures to benzo(a)pyrene and dibenz(a,h)anthracene.

The capping alternative meets the effectiveness criterion for protection of groundwater, as it reduces the leachability of chlorinated benzenes. The caps will reduce the quantity of rainwater infiltrating through soil contaminated with chlorinated benzenes above Florida guidance concentrations. Leachable soil is left in place to attenuate according to natural biotic or abiotic means. Due to the age of site constituents, it is unclear whether current volumes of soil contaminated with leachable compounds will significantly impact the aquifer any worse than the current scenario; therefore, it is not possible to gauge the impact of the capping scenario. Constituent concentrations in Areas B, C, and D are expected to decrease through natural biotic or abiotic attenuation processes, thus rendering the soil less threatening to groundwater with time. Capping may slow attenuation to rates less than would be seen in a no-action alternative.

Groundwater monitoring may be required by USEPA/FDEP to monitor the effectiveness of the caps. However, it is not clear if variations in groundwater quality could be attributed to cap construction or the RCRA containment/recovery system. Continued monitoring in conjunction with the current RCRA program should be adequate to assess changes in constituent distribution. Separate groundwater monitoring activities are not recommended to supplement Alternative 3.

2.3.4 Alternative 3: Cost

Cost components for the capping alternative include the following:

- Grubbing and grading (Area A)
- Replacement of the fence (Areas A and C)
- 5 inches of asphalt pavement
- 6 inches of base course

Capital costs associated with the capping alternative are shown in Table 2-3.

Total capital costs associated with this alternative are $29,000, not including engineering, design, or contingency costs. Maintenance costs for the capping alternative are expected to focus on cap surfacing. Resealing the caps with a 1-inch topcoat annually is expected to cost less than $3,000 to $6,000.

2.4 Alternative 4: Excavation with Offsite Disposal

In the excavation and offsite disposal alternative, soil exceeding PRGs will be removed from OU 10 and disposed at an approved Subtitle D landfill. The purpose of this alternative is to remove all current and future threats to human health and the environment posed by soil contamination in Areas A, B, C, and D.

Table 2-3
Capital Costs for the Capping Alternative

Action	Quantity	Cost per Unit	Total Cost
Grading	965 S.Y.	$1.50/SY	$1,400
Grubbing	965 S.Y.	$0.25/SY	$200
Fencing	200 L.F. (assume all fencing adjacent to Areas A and C require replacement)	$17/LF	$3,400
Base course	965 S.Y.	$15/SY	$14,500
Topcoat	965 S.Y.	$10/SY	$9,700

Notes:

Areas are based on the following:

Area A = 2,500 SF =	280 SY	Total area =	965 SY
Area B = 1,760 SF =	195 SY	SY —	Square yard
Area C = 1,880 SF =	210 SY	SF —	Square foot
Area D = 2,500 SF =	280 SY	LF —	Linear foot

2.4.1 Alternative 4: Remedial Elements

Remedial activities in this alternative will consist of the following elements:

- Grubbing
- Excavation
- Confirmatory sampling (lateral)
- Backfill
- Transport of excavated material offsite
- Landfilling in a Subtitle D facility.

Grubbing in Area A will be required before excavation. Excavation in Areas B and C may be complicated by the presence of the RCRA groundwater recovery system. Excavation techniques will need to account for existing utilities in these areas. Excavation in Area D may also need to consider utilities and treatment unit foundations. Because the water table fluctuates seasonally, water table suppression may be required to remove soil in the 3- to 4-foot interval. Volumes of extracted groundwater are expected to be relatively small, and may be discharged to the wastewater treatment plant. Confirmatory sampling is recommended to verify that the lateral extent of contamination above PRGs has been removed.

A review of RI data suggests that treatment will not be required for site constituents prior to disposal; the soil is not considered a hazardous waste. However, Toxicity Characteristic Leachate Procedure (TCLP) analyses will be required for all soil disposal to demonstrate that the soil does not exhibit the toxicity characteristic. Of the constituents in Areas A, B, C, and D, only chlorobenzene and 1,4-dichlorobenzene may exhibit the toxicity characteristic if TCLP results exceed 100 milligrams per liter (mg/L) and 7.5 mg/L, respectively. Since the soil concentrations of total chlorobenzene proposed for excavation range from 0.6 to 2.9 milligrams per kilogram (mg/kg), and the total 1,4-dichlorobenzene concentrations range from 0.9 to 12 mg/kg, excavated soil is not expected to exhibit the toxicity characteristic.

Because soil constituent concentrations are low, and are not expected to exhibit the toxicity characteristic, soil will be disposed in a permitted, Subtitle D landfill (such as Escambia County's Perdido Landfill). If samples fail TCLP analyses, disposal at a permitted treatment, storage, and disposal facility may be required.

2.4.2 Alternative 4: Implementability

This alternative is both technically and administratively feasible at OU 10.

Excavation is a commonly performed remedial action. It is a reliable method for removing contaminated soil within given boundaries. In cases where lateral boundaries are not clearly defined, confirmatory sampling can be used during excavation to determine the limits of excavation. No technology-specific regulations which apply to excavation and landfilling alternatives. No long-term maintenance or monitoring is required once soil above PRGs has been removed.

The excavation and landfilling alternative is administratively feasible at OU 10. Escambia County's Perdido landfill is approximately 20 to 30 miles from NAS Pensacola and has accepted soil from interim removal actions on station (e.g., Site 39). Because the volume of soil that will be generated, no capacity limitations are expected at the landfill. Transporting the soil from OU 10 to the disposal facility will require scheduling to minimize costs for roll-off boxes and downtime.

2.4.3 Alternative 4: Effectiveness

The excavation with offsite disposal alternative is protective of human health and the environment at OU 10. This alternative reduces the quantity of soil with concentrations above PRGs onsite, but does not reduce the toxicity, mobility, or volume of contaminants through statutory preference for treatment.

Short-term inhalation, ingestion, and contact risks to site workers (both excavation crew and treatment plant employees) will increase due to excavation activities. However, these risks can be minimized through proper use of personal protective equipment (PPE) and engineering controls. Because no residential areas are adjacent to OU 10, there are no short-term risks to the surrounding community. Short-term risks are expected to last for at least 6 months, until remedial actions are complete.

No onsite long-term risks above $1x10^{-6}$ are associated with this alternative, as all soil contaminated above residential and leachability-based PRGs will be removed. The Navy may incur limited liability if remedial activities are required at the disposal facility.

2.4.4 Alternative 4: Cost

Cost components for the excavation/landfilling alternative include the following:

- Grubbing and grading (Area A)
- Replacement of the fence (Areas A and C)
- Excavation
- Backfill
- Dewatering
- Transportation
- Disposal

These costs are detailed in Table 2-4, below.

Table 2-4
Capital Costs for Excavation and Offsite Landfilling

Action	Quantity	Cost per Unit	Total Cost
Grubbing	965 S.Y.	$0.25/S.Y.	$200
Fencing	200 L.F. (assume all fencing adjacent to Areas A and C require replacement)	$17/L.F.	$3,400
Excavation	955 S.Y.	$20/C.Y.	$19,100
Backfill	955 S.Y.	$15/C.Y.	$14,300
Transportation	50 trucks (assuming 20 C.Y. trucks) hauling 30 miles	$3.50/loaded mile	$5,300
Disposal	955 S.Y.	$50/C.Y.	$47,800

Notes:

Areas are based on the following are based on the same assumptions presented for Alternative 3. Volumes are presented in Table 1-2.

SY — Square yard
LF — Linear foot

Total costs presented above are \$90,000, not including engineering, design, or contingency costs. Dewatering may be required during removal activities. Short-term dewatering costs are expected to be \$10,000 per week for equipment rental and operation.

Confirmatory sampling will be required from each area during excavation to verify that soil contamination exceeding PRGs has been excavated. Assuming four grab samples will be collected from each of the four areas, confirmatory sampling costs will be approximately \$20,000, including sampling, sample analysis, data review, and reporting.

Factors affecting disposal costs include the final volume of soil excavated and the degree of treatment (if any) required.

3.0 DETAILED ANALYSIS OF ALTERNATIVES

3.1 Evaluation Process

In this section, the remedial alternatives discussed in Section 2 will be examined with respect to requirements stipulated in CERCLA as amended, the NCP, OSWER Directive No. 9355.9-19 (*Interim Guidance on Superfund Selection of Remedy*, December 24, 1986), and factors described in OSWER Directive No. 9355.3-01 (*Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, October 1988).

The detailed analysis of alternatives consists of the analyzing and presenting the relevant information needed to allow decision-makers to select a site remedy, but does not replace the decision-making process. During the detailed analysis, each alternative will be assessed against the evaluation criteria and all other alternatives. The results of the assessment are arrayed to compare the alternatives and identify the key tradeoffs among them. This approach to analyzing alternatives is designed to provide decision-makers sufficient information to adequately compare the alternatives, select an appropriate remedy for a site, and demonstrate satisfaction of the CERCLA remedy selection requirements.

Nine evaluation criteria have been developed to address the CERCLA requirements and considerations, and to address the additional technical and policy considerations that have proven to be important for selecting among remedial alternatives. These evaluation criteria serve as the basis for conducting the detailed analyses during the FFS and for subsequently selecting an appropriate remedial action. The evaluation criteria with the associated statutory considerations are:

- Short-term effectiveness
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Implementability

- Cost
- Compliance with ARARs
- Overall protection of human health and the environment
- State acceptance
- Community acceptance

Each remedial alternative is evaluated with respect to the above criteria, as described in the following sections. In Section 4, the statutory factors and nine criteria listed above are compared for each alternative to assist in the remedy selection process.

3.1.1 Short-Term Effectiveness

The short-term effectiveness of a remedial alternative is evaluated relative to its effect on human health and the environment during implementation of the remedial action. The short-term effectiveness assessment is based on four key factors:

- Risks that occur to the community during implementation of the remedial action;
- Risks to workers during implementation of the remedial action;
- Potential for adverse environmental impact to occur as a result of implementation of the remedial action; and
- Time until remedial response objectives are achieved.

3.1.2 Long-Term Effectiveness and Permanence

The evaluation of alternatives under this criterion addresses the results of a remedial action in terms of the risk remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the risk posed by treatment residuals and/or untreated wastes. The following components of the criterion should be addressed for each alternative:

- **Magnitude of Residual Risk:** This factor assesses the residual risk from untreated waste or treatment residuals at the conclusion of remedial activities. The potential for this risk may be measured by numerical standards such as cancer risk levels or the volume or concentration of constituents in waste, media, or treatment residuals remaining onsite.

- **Adequacy and Reliability of Controls:** This factor assesses the adequacy and suitability of controls, if any, that are used to manage treatment residuals or untreated wastes remaining onsite. It may include an assessment of containment systems and institutional controls to determine if they are sufficient to ensure that any exposure to human and environmental receptors is within protective levels.

3.1.3 Reduction of Toxicity, Mobility, or Volume

This evaluation criterion addresses the statutory preference for remedial actions employing treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances.

The evaluation should consider the following specific factors:

- The treatment processes, the remedies they will employ, and the materials they will treat;

- The amount of hazardous materials that will be destroyed or treated, including how principal threat(s) will be addressed;

- The degree of expected reduction in toxicity, mobility, or volume, measured as a percentage of reduction (or order of magnitude) when possible;

- The degree to which the treatment will be irreversible;

- The type and quantity of treatment residuals that will remain following treatment; and

- Whether the alternative would satisfy the statutory preference for treatment as a principal element.

3.1.4 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. This criterion involves analysis of the following factors:

- **Technical Feasibility:**

  — *Construction and operation* relating to the technical difficulties and unknowns associated with a technology.

  — *Reliability of technology* focusing on the likelihood that technical problems associated with implementation will lead to schedule delays.

  — *Ease of undertaking remedial action* discussing, if any, future remedial actions that may be required and how difficult it would be to implement such additional actions.

  — *Monitoring considerations* addressing the ability to monitor the effectiveness of the remedy, including an evaluation of the risks of exposure should monitoring be insufficient to detect a system failure.

- **Administrative Feasibility:** Activities needed to coordinate with other offices and agencies.

- **Availability of services and materials:**

  — *Availability of adequate offsite treatment*, storage capacity, and disposal services.

  — *Availability of necessary equipment and specialists*, and provisions to ensure any necessary additional resources.

  — *Availability of services and materials*, plus the potential for obtaining competitive bids, which may be particularly important for innovative technologies.

  — *Availability of prospective technologies.*

3.1.5 Cost

A detailed cost estimate is developed for each remedial alternative. These estimates are based on engineering analyses, estimates by suppliers of necessary technology and costs for similar actions (such as excavation) at other CERCLA and RCRA sites. Costs are expressed in 1994/1995 dollars. The cost estimate for a remedial alternative consists of four principal elements: capital cost, operation and maintenance cost, costs for five-year evaluation reports, and present worth analysis. Capital costs include:

- **Direct Cost:** for equipment, labor, and materials used to develop, construct, and implement a remedial action.

- **Indirect Cost:** for engineering, financial, and other services that are not actually a part of construction but are required to implement a remedial alternative. The percentage applied to the direct cost varies with the degree of difficulty associated with construction and/or implementation of the alternative. In this FFS, the indirect costs include health and safety (H&S) items, permitting and legal fees, bid and scope contingencies, and engineering design and services.

- **Annual O&M Costs:** Operations and maintenance (O&M) costs refer to post-construction costs necessary to ensure the continued effectiveness of a remedial action. They typically refer to long-term power and material costs (such as the operational cost of a water treatment facility), equipment replacement costs, and long-term monitoring costs.

- **Costs for Five Year Evaluation Reports:** This refers to the costs associated with reports prepared every five years evaluating the results of monitoring activities.

- **Present Worth Analysis:** This analysis makes possible the comparison of remedial alternatives on the basis of a single cost representing an amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A 30-year performance period is assumed for present worth analyses. Discount rates of 6 percent are assumed for base calculations. An increase in the discount rate would be reflected as a decrease in the present worth of the alternative.

The cost elements for each remedial alternative are summarized in the cost analysis section. The study estimate costs provided for the alternatives are intended to reflect actual costs with an accuracy of minus 30 percent to plus 50 percent, in accordance with USEPA guidelines.

3.1.6 Compliance with ARARs

This evaluation criterion is used to determine whether each alternative will meet all the federal and state ARARs that have been identified in previous stages of the remedial process. The detailed analysis should identify which requirements are applicable or relevant and appropriate to an alternative. The following should be addressed for each alternative during the detailed analysis of ARARs:

- Compliance with chemical-specific ARARs
- Compliance with location-specific ARARs
- Compliance with action-specific ARARs

The actual determination of which requirements are applicable or relevant and appropriate is made by the lead agency (the Navy) in consultation with the support agencies (USEPA and FDEP).

3.1.7 Overall Protection of Human Health and the Environment

This evaluation criterion provides a final check to assess whether each alternative adequately protects human health and the environment. The overall assessment of protection draws on the assessments conducted under other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

Evaluation of the overall protectiveness of an alternative should focus on whether an alternative achieves adequate protection by eliminating, reducing, or controlling the risks posed through each pathway, through treatment, engineering, or institutional controls. This evaluation also allows for consideration of whether an alternative poses any unacceptable short-term or cross-media impacts.

3.1.8 State Acceptance

This assessment evaluates the technical and administrative issues and concerns the state may have regarding each alternative. This criterion is largely satisfied through state involvement in the entire remedial process, including review of the FFS.

3.1.9 Community Acceptance

This assessment evaluates the issues and concerns the public may have regarding each of the alternatives. As with state acceptance, this criterion will be addressed in the Record of Decision (ROD) when comments on the FFS have been received.

3.2 Evaluation of Selected Alternatives

The following sections present a detailed analysis of each alternative presented in Section 2.

3.2.1 No Action

In the no-action alternative, required by the NCP, no soil actions will take place at OU 10. Soil exceeding residential PRGs will be left in place. Constituents are expected to attenuate through natural biotic or abiotic means. The site will be monitored and reassessed once every five years for 30 years.

Short-Term Effectiveness

Short-term effectiveness assesses the effects of an alternative on human health and the environment while implementing the remedial alternative. There are no implementation concerns associated with the no-action alternative. This alternative may be implemented immediately.

Long-Term Effectiveness and Permanence

The long-term effectiveness criterion evaluates the results of a remedial action in terms of the risk remaining onsite, particularly in terms of the magnitude of residual risk and the adequacy and reliability of controls. The no-action alternative does not reduce the magnitude of residual risk; specifically, risk to future child residents slightly exceeds the $1x10^{-6}$ threshold. Chlorinated benzenes, which may pose a leaching risk to groundwater, remain in site soil. Site groundwater was impacted by chlorinated benzenes from RCRA units and is being remediated under RCRA post-closure actions.

Any controls which are currently in place at the site — which include military security, limited access to the site, and fencing — will remain. These controls are considered reliable for protecting human health given the current and projected land use at the site.

Reduction of Toxicity, Mobility, or Volume

This criterion evaluates reductions in toxicity, mobility, or volume of contaminants exceeding PRGs; the criterion prefers permanent treatment alternatives. The no-action alternative does not satisfy this criterion. Soil contaminated in excess of PRGs will remain in place onsite; no treatment is effected during remedial actions. However, intrinsic remediation processes (either biotic or abiotic degradation) will continue. Intrinsic remediation is considered irreversible.

Implementability

The implementability criterion typically addresses the technical and administrative feasibility of an alternative with respect to three subcriteria, identified below.

Technical Feasibility — The no-action alternative is technically feasible. No construction, operation, or reliability issues are associated with this alternative. Current site controls — including military security, limited access to personnel, and fencing — have historically been reliable access controls. Monitoring will be required once every five years for 30 years to assess changes in constituent distribution.

Administrative Feasibility — No administrative coordination is required for implementation of the no-action alternative.

Availability of Services and Materials — The no-action alternative will not require offsite services, materials, specialists, or innovative technologies.

Cost

The cost breakdown associated with Alternative 1 is presented in Section 2.1.4. Direct costs associated with soil and groundwater sampling are expected to be approximately $43,000 per event. Assuming a 30 percent contingency, total direct and indirect costs are $55,900 per event. If groundwater sampling is conducted once every five years for the next 30 years, at an annual discount rate of 6 percent, the present worth cost of this alternative is $136,000.

Compliance with ARARs

This criterion assesses whether the alternative meets federal and state ARARs, as well as identifies specific ARARs for each alternative. The no-action alternative does not comply with the chemical-specific ARAR developed in the BRA and proposed as a PRG for protection of future child residents by reducing benzo(a)pyrene and dibenz(a,h)anthracene concentrations in surface soil below the $1x10^{-6}$ residential risk threshold.

This alternative also does not address the TBC criteria for protection of groundwater, as identified in the FDEP's *Soil Cleanup Goals for Military Sites*; chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and naphthalene are present in soil in three areas above guidance concentrations protective of groundwater.

The no-action alternative does not trigger any location- or action-specific ARARs.

Overall Protection of Human Health and the Environment

This criterion is used to assess the overall protectiveness of the alternative, particularly with respect to long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs. The no-action alternative does not afford any long-term effectiveness and permanence under a residential scenario beyond natural degradation of constituents. No short-term impacts are associated with this alternative. This alternative does not comply with chemical-specific ARARs and TBC criteria.

However, due to the small volumes of constituents present at OU 10, as well as the likelihood that the OU 10/Magazine Point area will remain an industrial area due to the wastewater treatment plant, the institutional controls presently in place at OU 10 (including military security, access controls, and fencing) may be adequate to restrict human contact with soil contaminated above risk-based PRGs (current and future site worker risks).

Similarly, the volumes associated with soil exceeding guidance concentrations protective of groundwater are relatively small; due to soil heterogeneity, it is likely that soil concentrations do not exceed guidance concentrations everywhere in the area designated to be removed. With the RCRA groundwater recovery system currently in place, and the degree of contaminated groundwater being addressed under the RCRA program, any additional contributions to contaminated groundwater from Areas B, C, and D will be minimal.

State Acceptance

The state has been involved in the RCRA and previous CERCLA activities at OU 10 and it will have the opportunity to comment on this FFS.

Community Acceptance

The community acceptance will be determined following the public comment period.

3.2.2 Institutional Controls

The primary element in the institutional controls alternative is zoning the OU 10 area for industrial use only; this action will preclude a future child resident scenario. Soil contaminants will be left in place. Constituents are expected to attenuate through natural biotic or abiotic means.

Short-Term Effectiveness

Short-term effectiveness assesses an alternative's effects on human health and the environment while it is being implemented. There are no implementation concerns associated with the institutional controls alternative. This alternative may be implemented as soon as a leachability study has been conducted to demonstrate that Areas B, C, and D are not contributing significantly to groundwater contamination onsite, and the NAS Pensacola Master Plan has been amended.

Long-Term Effectiveness and Permanence

The long-term effectiveness criterion evaluates the results of a remedial action in terms of the risk remaining onsite, particularly in terms of the magnitude of the residual risk and the adequacy and reliability of controls. The institutional controls alternative would eliminate residual risk to future child residents by zoning OU 10 strictly as an industrial area and preventing it from being used for residential purposes. Any controls which are currently in place at the site — including military security, limited access to the site, and fencing — will remain. These controls are considered reliable for protecting human health given the current and projected land use at the site. Site groundwater impacted by RCRA units containing chlorinated benzenes is currently being addressed under RCRA post-closure actions.

A leachability study will be conducted to determine if groundwater is adversely impacted by soil contaminated above Florida leachability-based guidance concentrations. This leachability study will be conducted during the RD/RA period following ROD issuance. If the leachability study determines that COCs are contributing unacceptable levels of contaminants to site groundwater, Alternative 4 (excavation with offsite disposal) will be used as a contingency remedy to remove all soil with concentrations not protective of groundwater.

Reduction of Toxicity, Mobility, or Volume

Institutional controls will prevent contact of future child residents with contaminated soil at OU 10. Soil contaminated in excess of residential PRGs will remain in place onsite. If the leachability study determines that site soil contaminated above Florida leachability-based guidance concentrations COCs is contributing unacceptable levels of contaminants to site groundwater, excavation and disposal activities will be implemented for protection of the environment. No risk is posed to site workers under the industrial-use scenario. No treatment is effected during remedial action. However, intrinsic remediation processes (either biotic or abiotic degradation) will continue. Intrinsic remediation is considered to be irreversible.

This selected alternative does not reduce toxicity, mobility, or volume through treatment, and does not satisfy the statutory preference for treatment as a principal element.

Implementability

The implementability criterion typically addresses the technical and administrative feasibility of an alternative with respect to three subcriteria, identified below.

Technical Feasibility — The institutional controls alternative is technically feasible. No construction, operation, or maintenance issues are associated with this alternative. No technology-specific regulations apply. Current site controls — including military security, limited access to personnel, and fencing — have historically been reliable access controls.

Administrative Feasibility — No problems are anticipated performing the leachability study or revising the NAS Pensacola Master Plan to ensure future development on Magazine Point is restricted to industrial uses.

Availability of Services and Materials — The institutional controls alternative will not require offsite services, materials, specialists, or innovative technologies.

Cost

Cost components for the institutional controls alternative include the following:

- Soil sampling
- Leachability analysis and report compilation

Costs associated with the leachability study are detailed in Section 2.2.4. Direct costs for leachability analysis are approximately $50,000. Assuming a 30 percent contingency, total direct and indirect costs are $65,000. If the leachability study determines that soil exceeding Flordia leachability-based guidance concentrations poses unacceptable threats to groundwater, additional costs will be incurred by excavating and disposing of contaminated soil. These costs are detailed for Alternative 4 in Section 2.4.4.

If excavation and disposal are required, total direct costs for excavation and disposal are estimated to be $90,000, excluding dewatering; dewatering will add approximately $10,000 per week. Indirect costs, including engineering and design (30 percent), and contingencies (30 percent), are expected to increase total project costs to $152,000. No O&M or sampling costs will be required under the contingent plan.

Compliance with ARARs

This criterion assesses whether the alternative meets federal and state ARARs, as well as identifies specific ARARs for each alternative. The institutional controls alternative complies with the chemical-specific ARAR developed in the BRA by reducing the potential exposure of a future child resident to contaminants exceeding residential PRGs.

This alternative addresses the potential for contaminant migration to groundwater by conducting a site-specific leachability analysis. If chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and naphthalene (where present in soil above Florida leachability-based guidance concentrations) are found to contribute excessively to groundwater contamination, then soil from Areas A, B, C, and D will be removed as per Alternative 4.

Overall Protection of Human Health and the Environment

This criterion assesses the adequacy of an alternative with respect to the long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs criteria.

Under an industrial scenario, the institutional controls alternative addresses the long-term effectiveness and permanence criterion by preventing exposure to the contaminant source. If OU 10 remains industrial, no further actions will be required to protect human health. The contaminated soil will be left onsite indefinitely, attenuating through natural biotic or abiotic means (intrinsic remediation). No short-term impacts are associated with this alternative. This alternative does comply with chemical-specific ARARs but does not meet the TBC criteria for protection of groundwater.

To address this concern, a leachability study will be conducted during the RD/RA period following ROD issuance. If the leachability study determines that COCs are contributing unacceptable levels of contaminants to site groundwater, Alternative 4 (excavation with offsite disposal) will be used as a contingency remedy to remove all soil with concentrations not protective of groundwater.

State Acceptance

The state has been involved in the RCRA and previous CERCLA activities at OU 10, and will have the opportunity to comment on this FFS.

Community Acceptance

The community acceptance will be determined following the public comment period.

3.2.3 Capping

The primary element in the capping alternative is containment — reducing potential risk to human health and the environment by eliminating the exposure pathway (dermal contact) and preventing contaminated leachate generation.

Short-Term Effectiveness

Short term effectiveness assesses the effects of an alternative on human health and the environment while implementing the remedial alternative. While constructing the caps, both construction workers and treatment plant employees will be exposed to increased particulate emissions. However, worker risks can be minimized by implementing dust control technologies (e.g., water, foam sprays) and a site-specific health and safety plan which specifies PPE, respiratory protection, etc. Adverse impacts to the surrounding environment are not anticipated during cap construction; engineering controls can be applied to manage storm water runoff and siltation, if necessary.

Once design plans are approved, actual construction of the caps is expected to take 1 to 6 months. Implementation may be staged over a longer period of time to meet the needs and requirements of the wastewater treatment plant.

Long-Term Effectiveness and Permanence

As with the no-action alternative, the long-term effectiveness criterion evaluates the results of a remedial action in terms of the risk remaining at the site, particularly in terms of the magnitude of residual risk and the adequacy and reliability of controls.

The contaminated soil will be isolated, thus reducing and/or preventing leachate production due to infiltration. The caps would require proper observation and maintenance; caps are generally regarded as reliable containment controls. Ongoing groundwater monitoring in conjunction with closed RCRA units adjacent to these areas should effectively monitor changes in groundwater concentrations.

Contaminated soil would remain in place onsite; if the caps fail, risks to future child residents from Area A would be unchanged. Areas capped due to leachability concerns (Areas B, C, and D) would be exposed to infiltrating rainwater, and may contribute to leachate generation. However, risks to human health and the environment onsite are expected to decrease with time, as constituents attenuate through natural biotic or abiotic degradation.

Reduction of Toxicity, Mobility, or Volume

Capping will eliminate human contact with soil in Area A and reduce leachate generation and infiltration into the groundwater in Areas B, C, and D; this alternative is a containment alternative. Intrinsic remediation processes (either biotic or abiotic degradation) will continue after the cap is installed. Aside from natural degradation action, this alternative is considered to be reversible, since the constituents will remain onsite; if the caps fail because of poor maintenance, constituents may be exposed.

This selected alternative does not reduce toxicity, mobility, or volume through treatment, and does not satisfy the statutory preference for treatment as a principal element.

Implementability

The capping alternative is implementable at OU 10; this alternative is compatible with current use at the wastewater treatment plant.

Technical Feasibility — The capping alternative is technically feasible. The caps proposed for OU 10 are asphalt, and may be used as parking areas or access roads. This common containment technique has been applied at numerous sites. The cap design must address construction adjacent to existing RCRA recovery wells and plant operations. This alternative can be readily applied at this site, given that asphalt paved areas are adjacent to the four major areas of contamination. Thus, implementing this alternative would merely involve extending the existing asphalt. Future monitoring and maintenance actions will involve inspecting the cap periodically and repairing any damage or degradation. However, these repair activities are easily implemented, involving only reinforcement of the existing asphalt; similar actions are under way for the RCRA cap at Site 32.

Administrative Feasibility — During construction of the caps, some administrative coordination will be required to address underground utilities and incorporate daily plant operations into the capping work plan. Implementation may be slowed if capping activities hinder or obstruct wastewater treatment plant operations.

Availability of Services and Materials — The capping alternative will not require any extraordinary services or materials. Qualified paving companies are readily accessible. No offsite storage or treatment, or prospective/innovative technologies are required.

Cost

The cost breakdown associated with the capping alternative is detailed in Section 2.3.4. Direct capital costs associated with cap construction are $29,000; including 30 percent for engineering and design costs and an additional 30 percent for contingencies, direct and indirect costs for the project are $46,000. Annual maintenance costs are expected to be $3,000 to $6,000 per year. Assuming the latter, the present worth of annual maintenance costs is $83,000. The total present value of Alternative 3, therefore, is $129,000 (assuming a 6 percent discount rate over 30 years).

Compliance with ARARs

This criterion assesses whether the alternative meets federal and state ARARs, as well as identifies specific ARARs for each alternative. The capping alternative complies with the chemical-specific ARAR developed in the BRA and proposed as a PRG for protection of future child residents by reducing the potential for contact with benzo(a)pyrene- and dibenz(a,h)anthracene-contaminated surface soil above the $1x10^{-6}$ risk threshold.

This alternative also addresses the TBC criteria for protection of groundwater, as identified in the FDEP's *Soil Cleanup Goals for Military Sites*. Areas B, C, and D are capped to reduce the quantity of leachate generated by infiltrating rainwater. The purpose of the caps is to isolate constituents exceeding residential risk and guidance concentrations in environmental media, not to manage solid or hazardous waste. Therefore, RCRA capping requirements are not an ARAR. The intent of RCRA to minimize leachate through contaminated areas will be considered when completing final design for the asphalt caps.

Site grading activities may require compliance with federal, state, and local air emissions and storm water control regulations. Occupational Safety and Health Administration (OSHA) health and safety regulations will apply to any remedial activities on a CERCLA site.

This alternative does not trigger any location-specific ARARs.

Overall Protection of Human Health and the Environment

As discussed in Section 3.1.7, this criterion assesses the adequacy of an alternative with respect to the long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs criteria.

Under a residential scenario, the capping alternative addresses the long-term effectiveness and permanence criterion by containing the contaminated soil, therefore controlling all exposure to the source. It minimizes further release of constituents to the groundwater by limiting infiltration. The contaminated soil will be left onsite indefinitely, attenuating through natural biotic or abiotic means (intrinsic remediation); the caps will be monitored to ensure adequate protection. Short-term risks from dust and inhalation exposures during implementation will be minimal, and can be controlled using common engineering techniques and PPE. This alternative will comply with ARARs and TBCs outlined above.

The capping alternative may offer intermediate protection to human health and the environment while intrinsic remediation processes are under way. Cap construction and maintenance are easily implemented remedial actions, and institutional controls present onsite (site security, access control, and fencing) are adequate to ensure minimal disturbance of onsite caps.

State Acceptance

The state has been involved in the RCRA and previous CERCLA activities at OU 10 and it will have the opportunity to comment on this FFS.

Community Acceptance

The community acceptance will be determined following the public comment period.

3.2.4 Excavation with Offsite Disposal

The primary element of this alternative is the excavation of soil contaminated above PRGs from the site with disposal in an approved landfill.

Short-Term Effectiveness

This criterion evaluates the effects of an alternative on human health and the environment during implementation. In the excavation alternative, both excavation workers and treatment plant employees will be exposed to increased particulate emissions. Excavation workers may also have greater dermal contact with hazardous constituents. However, worker risks can be minimized by implementing dust control technologies (e.g., water, foam sprays) and a site-specific health and safety plan which specifies PPE, respiratory protection, etc. Risks to the environment may include increased constituent concentrations in leachate from exposing contaminated soil to incipient rainfall.

Up to six months will be required to implement this alternative, once design plans are approved. Implementation may be staged over a longer period of time to meet the needs and requirements of the wastewater treatment plant.

Long-Term Effectiveness and Permanence

The long-term effectiveness criterion evaluates the results of a remedial action in terms of the risk remaining onsite. The magnitude of residual risk and the adequacy and reliability of controls are particularly emphasized in this criterion.

The excavation alternative removes the contaminated soil from the site and disposes it in a permitted Subtitle D facility. This alternative would eliminate risk to future child residents in Area A and would remove soil potentially threatening groundwater (Areas B, C, and D). Soil remaining onsite would not threaten human health or the environment.

Excavation with offsite disposal is a particularly reliable option, as soil is removed from the site. Onsite risks are eliminated. Some future liability may be incurred through disposal at a landfill.

Reduction of Toxicity, Mobility, or Volume

This criterion evaluates adherence to statutory preference for reducing toxicity, mobility, or volume through treatment. The excavation with offsite disposal alternative does not satisfy this preference for treatment; however, it is questionable whether treatment is required for such small soil quantities and low constituent concentrations. Excavation will eliminate the source area and, therefore, eliminate both human health risk (to future child residents) and the risk of leachate infiltrating into the groundwater. This alternative includes the removal of approximately 950 CY of soil from the site; this soil will be isolated in a secure landfill. Because the source will no longer remain onsite after this technology is employed, excavation is an irreversible method of treatment. This alternative does not reduce toxicity, mobility, or volume through treatment and, therefore, does not satisfy the statutory preference for treatment as a principal element.

Implementability

The excavation with offsite disposal alternative is implementable at OU 10; this alternative is compatible with current use at the wastewater treatment plant.

Technical Feasibility — Removal and offsite disposal are common remedial alternatives that have been applied at previous sites. The only potential technical problems that may slow removal activities are materials handling and disposal (standby time between confirmatory sampling and disposal), coordination with existing RCRA recovery wells and plant operations, and water table suppression, if required. Removal activities are anticipated to be easily implemented and would require no future remedial actions. It is likely that groundwater containment/water table suppression will be required at this site; a temporary wellpoint system will be sufficient for this purpose. Extracted groundwater volumes are expected to be relatively small, and groundwater may be discharged to the wastewater treatment plant via the RCRA pretreatment unit. Areas to be excavated are readily accessible. Underground utilities will need to be addressed during excavation activities. No future monitoring will be required after this alternative is completed.

Administrative Feasibility — During excavation, some administrative coordination will be required to address underground utilities and incorporate daily plant operations into the excavation work plan. Implementation may be slowed if removal activities hinder or obstruct wastewater treatment plant operations.

Availability of Services and Materials — The excavation with offsite disposal alternative will not require any extraordinary services or materials. The Perdito Landfill in Escambia County has accepted similar, non-hazardous soil from interim removal actions on station. These issues can be resolved during the design phase.

Cost

Detailed costs associated with Alternative 4 are presented in Section 2.4.4. Total direct costs are estimated to be $90,000, excluding dewatering; dewatering will add approximately $10,000 per week. Indirect costs, including engineering and design (30 percent), and contingencies (30 percent), are expected to increase total project costs to $152,000. No O&M or sampling costs are associated with this alternative.

Compliance with ARARs

This criterion assesses whether the alternative meets federal and state ARARs, as well as identifies specific ARARs for each alternative. The excavation with offsite disposal alternative complies with the chemical-specific developed in the BRA and proposed as a PRG for protection of future child residents. This alternative also addresses the TBC criteria for protection of groundwater, as identified in the FDEP's *Soil Cleanup Goals for Military Sites*.

Excavation activities onsite may require compliance with federal, state, and local air emissions and storm water control regulations. Transportation offsite will trigger U.S. Department of Transportation regulations. Land disposal restrictions will not be triggered because the contaminated soil is not a hazardous waste. OSHA health and safety regulations will apply to any remedial activities on a CERCLA site.

No location-specific ARARs will be triggered by this alternative.

Overall Protection of Human Health and the Environment

This criterion evaluates the adequacy of an alternative with respect to the following three criteria: long-term effectiveness and permanence; short-term effectiveness; and compliance with ARARs.

The excavation with offsite disposal alternative addresses the long-term effectiveness and permanence criterion by removing contaminated soil from the site. Risks to human health under a residential scenario and the environment due to potential leachability are eliminated. Short-term risks from inhalation and dermal contact exposures during implementation will be minimal, and can be controlled using common engineering techniques and PPE. This alternative will comply with ARARs and TBCs outlined above.

The excavation with offsite disposal alternative is the most aggressive remedial action proposed in this FFS. This alternative is easily implemented, and is protective of both future child residents and the environment.

State Acceptance

The state has been involved in the RCRA and previous CERCLA activities at OU 10 and it will have the opportunity to comment on this FFS.

Community Acceptance

The community acceptance will be determined following the public comment period.

4.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides a comparative analysis of alternatives, examining potential advantages and disadvantages of each as per the nine criteria.

4.1 Threshold Criteria

All alternatives considered for selection must comply with the threshold criteria, overall protection of human health and the environment, and compliance with ARARs.

4.1.1 Overall Protection of Human Health and the Environment

This criterion evaluates, overall, the degree of protectiveness afforded to human health and the environment. It assesses the overall adequacy of each alternative.

Protection of Human Health

As discussed in Section 1, no human health risks greater than $1x10^{-6}$ are posed to current or future workers at the treatment plant. If the OU 10 remains industrial, as proposed in Alternative 2 (institutional controls), no further actions will be required to protect human health.

Alternative 1, no action, does not protect future child residents from incidental ingestion pathway carcinogenic risk (computed to be $6x10^{-6}$) or the dermal pathway risk ($2x10^{-6}$). Concentrations detected are within the carcinogenic risk range considered acceptable by the USEPA ($1x10^{-6}$ to $1x10^{-4}$); these values only slightly exceed the risk considered acceptable by FDEP ($1x10^{-6}$). <u>There are no indications that the Magazine Point area will be used for residential purposes in future use scenarios</u>.

Protection of the Environment

The BRA concluded there were no risks to the environment (i.e., ecological) due to contamination at OU 10 associated with sediment, surface water, or groundwater. If

State of Florida TBCs are considered appropriate to OU 10 with respect to protection of groundwater, alternatives 1 through 4 provide varying degrees of protection to the environment.

The no-action alternative does not address soil in excess of FDEP leachability-based guidance concentrations for chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, and naphthalene. As discussed in Section 1, these constituents are present in groundwater, possibly due to the closed RCRA units at Sites 32 and 33. A RCRA groundwater containment/recovery system is operating onsite. It is unclear from current site data (and highly unlikely given the age of the contamination) whether current volumes of soil contaminated with leachable compounds will significantly impact the aquifer any worse than the current scenario. Alternative 2, institutional controls, seeks to quantify threats to the environment from Areas B, C, and D. If risks are deemed unacceptable, this alternative relies on Alternative 4 (excavation and disposal) as a contingency remedy.

Alternative 3 affords long-term protection of the environment by significantly reducing the quantity of rainfall infiltrating through contaminated soil; Alternative 4 removes the soil from the site and secures it in an approved landfill.

4.1.2 Compliance with ARARs

As discussed in Section 1, no threats to human health above the $1x10^{-6}$ risk threshold are present under the current-use (industrial) scenario. If the site remains industrial, as in the institutional controls alternative (alternative 2), no further action will be required at OU 10 to protect human health. If compliance with future residential use scenario is required, only Alternatives 3 and 4 will comply with ARARs. Alternatives 1 and 2 slightly exceed the $1x10^{-6}$ threshold for future child residents.

Compliance with action- and location-specific ARARs for Alternatives 3 and 4 is anticipated and easily attainable.

If State of Florida TBCs are considered applicable to the site, Alternatives 3 and 4 will comply with chemical-specific TBCs. Alternative 3, capping, reduces leachate generation in Areas B, C, and D. Alternative 4 eliminates risks to human health and the environment identified by TBCs through excavating contaminated soil and disposing it offsite. Alternative 2, institutional controls, seeks to quantify threats to groundwater using a site-specific leachability study. If threats are deemed unacceptable, soil is excavated and disposed as per Alternative 4.

As per the NCP, onsite remedial actions selected in the ROD must attain those ARARs that are identified at the time of the ROD signature or provide grounds for invoking a waiver under 300.430(f)(1)(ii)(C) (or CERCLA 121[d][4]).

4.2 Primary Balancing Criteria

Five primary balancing criteria typically highlight the major differences between alternatives. These criteria include: long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; short-term effectiveness; implementability; and cost.

4.2.1 Long-Term Effectiveness and Permanence

The long-term effectiveness and permanence criterion assesses the results of a remedial action in terms of the risk remaining at a site, particularly in terms of the magnitude of remedial risk and the adequacy and reliability of controls.

Magnitude of Residual Risk

As stated in the BRA, no risk is posed to current and future site workers at OU 10; no further action is required at OU 10 to protect human health under an industrial-use scenario. Alternative 2 uses institutional controls to ensure future development in the Magazine Point area is limited to industrial use, thus eliminating all risk pathways to a future child resident.

If a residential use scenario is applied to the site, a residual risk slightly exceeding the $1x10^{-6}$ threshold is present for future child residents in the no-action alternative. This risk is well within the range deemed acceptable for carcinogenic risks by USEPA ($1x10^{-6}$ to $1x10^{-4}$); this risk slightly exceeds the $1x10^{-6}$ threshold preferred by FDEP.

Risks to future child residents are minimized in Alternative 3 by the presence of asphalt caps; this risk is eliminated in Alternative 4 by excavating and removing soil contaminated above the $1x10^{-6}$ threshold from the site.

Adequacy and Reliability of Controls

Controls inherent to OU 10 include fencing, limited access, and security provided by military personnel. If Magazine Point remains a part of the NAS Pensacola installation, these controls will be adequate for minimizing trespasser risks in Alternative 2, and no further actions are required to protect human health under an industrial scenario. There are currently no plans to convert Magazine Point into a residential area. The leachability study will be adequate to determine if site soil poses unacceptable risks to groundwater.

Alternative 3 provides slightly more reliable controls than the no-action alternative if Magazine Point and the treatment plant become residential areas. The asphalt caps will minimize contact of future child residents with soil contaminated above the $1x10^{-6}$ threshold and soil potentially leaching to groundwater. However, the caps will require annual maintenance to ensure that contact risks are reduced and infiltration is minimized.

Alternative 4 provides the most reliability from future residential risks, as soil is removed from the site. Some liability may be incurred through disposal at a landfill facility.

4.2.2 Reduction of Toxicity, Mobility, and Volume through Treatment

None of the four alternatives reduces toxicity, mobility, or volume of contaminants through treatment. Alternative 2 restricts future land use on Magazine Point to industrial applications. Alternative 3 reduces the leachability of constituents through containment. Alternative 4 removes constituents from the site.

4.2.3 Short-Term Effectiveness

No short-term effectiveness issues are associated with Alternatives 1 or 2, unless excavation and disposal are determined to be necessary by the leachability study. If excavation is required in Alternative 2, short-term effects will be identical to those posed by Alternative 4.

Both Alternatives 3 and 4 have short-term issues associated with implementation. In both alternatives, exposures to workers, treatment plant personnel, and the Magazine Point environs can be controlled using engineering controls and correct PPE during grading or excavating. Duration of field activities is relatively short, expected to require up to 6 months.

4.2.4 Implementability

All four alternatives are implementable at OU 10. Each alternative is technically and administratively feasible; none of the four alternatives requires special services or materials.

4.2.5 Cost

Capital (direct and indirect), O&M, and net present worth costs for all four alternatives are presented in Table 4-1, below.

4.3 Modifying Criteria

These criteria will be evaluated in detail following comment on the FFS report and the proposed plan, and will be addressed once a final decision is being made and the ROD is being prepared.

Preliminary comments from the State of Florida indicate that the state will consider TBC criteria applicable to remedial actions at OU 10.

Table 4-1
Cost Comparison for Alternatives

Alternative	Direct and Indirect Costs	Annual O&M Costs	Total Net Present Worth
Alternative 1	\$56,000	None	\$136,000
Alternative 2	\$65,000	None	\$65,000*
Alternative 3	\$46,000	\$6,000	\$129,000
Alternative 4	\$152,000	None	\$152,000

Notes:

Net present worth costs, where appropriate, were calculated using a 6 percent discount rate over a 30-year period.

Present worth costs for Alternative 1 were calculated assuming soil and groundwater sampling once ever five years.

* If the leachability study determines that threats to groundwater are unacceptable, present worth costs may increase to \$217,000 (including Alternative 4 costs).

5.0 REFERENCES

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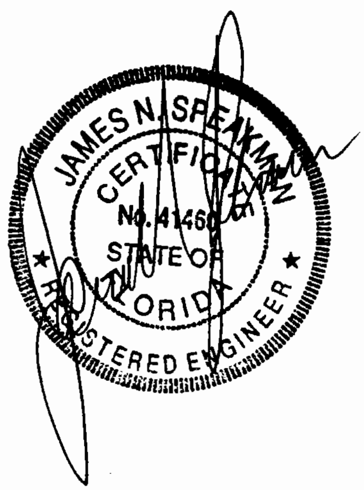
6.0 FLORIDA PROFESSIONAL ENGINEER'S SEAL

I am registered to practice engineering by the Florida State Board of Professional Examiners (License number 41460). I certify, under penalty of law, that the Final Focused Feasibility Study for Naval Air Station Pensacola Operable Unit 10 was performed in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, the information submitted is true, accurate, and complete, and the contents of this document are consistent with currently accepted engineering practices. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



October 26, 1995